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COST KEEPING IN THE BRASS FOUNDRY

SOME SUGGESTIONS AS TO HOW TO TRACE AND STOP LEAKS IN FOUNDRY OPERATION.

BY C. O. SKEEPER.

It is only in recent years that cost keeping in the brass foundry has been given the attention that it deserves, also the foundryman is now convinced that good cost keeping means larger profits and business. To try and outline a plan that would suit everybody concerned would, I believe, be a big job and one that would be open to perhaps some unjust criticism, due to the fact that we have some very heavy men, also a like share of light ones, in the brass foundry trade. Not very many superintendents of large manufacturing plants have an overload of foundry knowledge, but in many cases will decide contrary to what the foundry foreman suggests. We must take into account the fact that the foundry trade is at all times confronted by lightning rod salesmen of various products and machines, and the same is true of cost systems that are applicable to a brass foundry.

I know of one foundry that employed certified accountants and cost sharks to put their foundry, which was a large one, in good clerical shape. The reports in regards to losses, etc., were very bad as no doubt was the method of arriving at the final figures. The result of the investigation was as it nearly always is, that they were handed a system that was very good and one that could be run and show glowing results as long as the learned accountants were on the job. Now granting that not all jobs are paid for, based on the responsibility and education it takes to hold them down, you must agree with me that you cannot expect a ninety or one hundred dollar a month man to hold down and operate a system laid down and installed by a man commanding ten or fifteen dollars a day for his work. There are no doubt some exceptions to this rule, but not enough to go around all the brass foundries in the country that are in need of a better cost system.

I believe that a foundry in need of a better method of cost keeping and accounting should refer to the various foundries in the country, and from each one visited try and pick up some good point that will be of use to it and then put them all together and get a cost system that will be of some use. I am sure that one will soon learn to know that a good cost system in his foundry is as necessary to him as a barometer is when he wants to know the exact temperature, and he must not forget that he can readily procure good, fair, bad and worthless barometers.

METALS AND SCRAP TO FURNACE FLOOR

July 10 1914

COPPER	TIN	LEAD	ZINC	ANTIMONY						
2000	400	200								

FIG. 1. BLANK FOR STOCKMAN TO SHOW METAL DELIVERED TO FURNACE FLOOR.

You must ask the question, should my cost clerk be a college graduate? I would say that it is not necessary that he should be, but would rather figure on a man that had a little knowledge of a foundry, with a good education, and one that is able to advance his grey matter to a greater degree of activity. Should the day ever come that I would have the opportunity of operating a brass foundry, I would see for myself that I did not have any dead or near-dead wood in my organization. But if I had a good cost man, I would have an up-to-date foreman, for there is nothing so detrimental to any cost system as a foreman who imagines he has the whole thing under his hat and must give only such information as he thinks will not enable the other fellow to get in on the mysterious work. I am firmly of the opinion that the day is not far distant when these individuals who imagine that the foundry and their work is a little mysterious are due to wake up and find out that they have missed the train. Everything should be free and above board and in no other way can you expect success. As for me, I

will always choose the fellow that I can go to and from whom I can rely on for the information furnished as to any condition or conditions that may surround any job we may have in the shop.

First of all let us take our store's stock. This is a very important item. We must at all times know how much metal we have in stock and daily reports as to the consumption to enable us to keep our stock from getting too high or too low should be made. A clerical error might cause us to order metal at the wrong time, so it is taken for granted that every foundry has a perfect system of

METALS AND SCRAP TO FURNACE FLOOR

No OF ALLOY	DESCRIPTION	ORDER No OF JOB	WEIGHT
Pig Copper			2000
Tin			400
Lead			200

DATE July 10 STOCKMAN H. Wills

O.K. Jos. E. Smith No 1

FIG. 2. STOCKMAN'S TICKET THAT GOES TO COST CLERK.

taking care of their metal. A very simple system is by using a form as shown in Fig. 2.

The stockman upon request of the foreman of the furnaces delivers the required metal to the charging floor. The stockman fills out the slips, noting the grade and weight of the different metals delivered and, in addition, notes on his daily metal consumed report (Fig. 1) the same information as shown in Fig. 2. The form shown in Fig. 2 accompanies the metal to the charging floor and the foreman signs this slip if everything is O. K. and delivers the slips to the cost clerk each day. The stockman forwards the report of metal consumed daily to the cost clerk, who in turn makes a check to see that they agree and by this method we are able to keep an infallible record of our metals on hand and the weight consumed. You need have no argument with your furnaceman as regards his loss, for this method of having him sign for the metal makes him responsible for the weight and he will not be able to burn up a lot of your metal due to leaving the metal in too long and general carelessness that is sometimes practiced by the furnacemen. Most every foundry owner realizes what a careless furnaceman will do to his dividends, and you should be in a position to know that you are losing five or ten dollars each day, in a week's time, and not wait until the end of the month or fiscal year. Ten dollars a day means approximately $3,000 a year, so considering this lump sum you can readily afford to pay a good man, who will be on the job and furnish you with figures that you can depend upon.

There is great difference of opinion as to how the loss should be figured. Loss is loss regardless of what arguments you may advance to try and convince the foundryman that your loss is only the loss in zinc. Loss is the weight you have not got after your weight of finished castings is known, and that weight compared with the weight of metal or scrap charged to the furnace floor. A very simple explanation, if you have all your virgin metal and scrap in charge of one man, and this one man held responsible for the weight he delivers to the furnace floor and the furnaceman in turn held responsible for the metal he receives. So all summed up, loss is the difference in weight of the amount of metal and scrap charged to the foundry as compared with the weight of the castings the foundry is given credit for, and by all means do not charge metal purchased outside direct to your foundry floor, rather charge it to your stores stock and you will many times avoid errors in figuring your loss.

In giving out jobs to the molders a slip or tag noting the pattern and order number, number of castings required, and date wanted, is used; these slips should be handed to the foreman, who in turn makes arrangements for the delivery of the patterns or plates to his floor and gives the jobs out to the molder. Each day the molder notes the number of molds made and these slips are gathered up by the checker, who notes the number of molds made on the workman's contract or piece work slip, and in case the job is not finished the slip is returned to the molder the next morning. From this record a check is made of the castings shipped and you are able to deduct from the molder the defective molds he might produce. The workman each day turns in a time slip, as shown in Fig. 3, noting date, check number, name, order number, pattern number, number of molds made, hours worked and the contract number. These time slips are then O. K.'d by the foreman and turned over to the cost clerk, who checks same against the daily check board reading.

The question of getting the labor cost on special jobs and floor work on which you have no piece work rate can be taken care of by the workman turning in a time slip, as shown in Fig. 3, and noting the order number, pattern number, number of molds made and time spent on each job, and from these slips a posting can be made to a labor summary sheet as shown in Fig. 4. When the job is completed the sheet can be totalled up and used as a basis of getting the actual molding labor. This record also serves as a good efficient record on the molder, as the number of bad castings are noted on the sheet.

Most foundries know the cost per pound of their metal delivered to the pouring floor; that is, they have an idea

CHECK No 4 July 10 1914

NAME OF FOUNDRY

ORDER NUMBER	WORK DONE	CONTRACT NUMBER	HOURS REGULAR	HOURS OVER TIME	AMOUNT
14567	50 Molds Patt #500	84	9		
	Approved - J. Smith				

FIG. 3. WORKMAN'S TIME TICKET.

until the sales manager informs the force that Jones & Company are underselling and immediately they start to investigate, and where is one going to start unless he has some good figures to refer to that will show any fluctuations in the cost? Well, in many cases a good place to start is right at the furnaces.

The cost of cores is an important item and the foundry man should know the cost of each one. This can readily be determined by the fact that the labor is mostly piece

work and the cost of the material can be readily determined.

Then we have that old hoodoo, the cost of cleaning castings; should we base it on the average weight of the castings cleaned, or should we make a division of light and heavy castings? I should prefer the latter, as I have been used to our management paying piece work for having these castings cleaned; that is, so much per hundred pounds for sand-blasting, grinding and sawing.

MISCELLANEOUS EXPENSE.

Then we are brought face to face with the indirect factory expense, such as miscellaneous supplies, power, monthly salaries, including the cost clerk's salary, upkeep and depreciation of buildings and equipment, cost of repairs to flasks, etc., and insurance. The question is, how are these charges going to be divided to the proper place? Ye gods, what a mess! What say you in regards to this proposition? I would advise that such charges as power, upkeep of buildings should be based on floor space and charged to the core-room, cleaning and molding floor and furnace room and these charges included in the overhead of that division.

As we have such good helps for knowing the percentage of bad castings made, don't hope or think that this one item is small, but rather keep a record and be able to call somebody on the carpet and ask some very pointed questions whenever this end of the game assumes inconsistent proportions. Also by all means know what your relation of expense labor and material is to your productive labor. You perhaps might find out that your old foundry hasn't had a representative at the Foundrymen's Convention for a number of years, and you should also get a good line on your earned rate, for by having this information and using it to good advantage you can many times prevent labor troubles around your foundry.

You should also have a record for your own personal observation and perhaps consternation, showing monthly the average cost per pound of the labor cost of molders, core makers, cleaning castings, furnacemen, stockmen, shippers, foremen and clerks paid on an hourly and monthly rate, pattern loftmen, laborers, dumping molds and assisting the molder and your general labor such as unloading cars, cleaning ashes, etc., and then the material cost per pound of supplies for molders, coremakers, cleaning castings, repairing flanks, upkeep of your mechanical and electrical equipment, repairs to buildings, fuel, office supplies and miscellaneous charges. You can make a mighty good impression on the men who are responsible for these charges if you have the dope in front of you at that little gathering we so often have. This record enables you to keep in touch with about any most unusual increase in your expenses and is much better than counting your earnings and saying to yourself: well, something must have gone wrong, my earnings have decreased. Rather you should know in advance what the trouble is and save those troubling moments. Then when you are asked to donate ten or fifteen thousand dollars to a monument for the memory of by-gone foolish accounting days you will readily ask to see some figures supporting the arguments and be able to tell if it is worth while.

Arrangement counts a great deal for the success of a cost system and is a part of the foundry that should interest every one in the place, as it is the little things that count most and in the greater number of cases are the things that pass unnoticed. By all means give your cost clerk an insight into everything that happens along his line and if he is one of those individuals that can see further than the end of his nose, you will be repaid many times for your extra effort. I know of one foundry that had their office in the center of the building. It was decided that they would employ a cost man, who was duly installed, but at the start did not like the situation of the office. Now in most cases a complaint of this kind would receive the reception a roach usually gets when you discover him in your home. However, this foundry had it in mind to improve and when the cost man suggested that they move the office to the end of the foundry the foreman was in for the scheme, but did not think that the management would stand for the expense, and at that he was right, for the proposition was duly turned down. Not to be dismayed at this failure the cost man laid low for a couple of days and came back with this proposition: "Gentlemen, this office is not a clean or desirable place to work in and a move now will save you money. Your core work is situated where your office should be and the saving in labor in the distance the men have to go for cores will in a short time pay your expenses in moving the office and continue to save money." The result was that the office was moved and is but one of many instances where you can run your foundry in a more efficient manner.

LABOR SUMMARY SHEET

ORDER No.		PAT. No.		CUSTOMER			CASTINGS ON ORDER				CASTINGS STARTED					
DATE	CHECK No OF MOLDER	CASTINGS MADE	BAD CASTINGS	CASTINGS SHIPPED	LABOR COST	DATE	CHECK No OF MOLDER	CASTINGS MADE	BAD CASTINGS	CASTINGS SHIPPED	LABOR COST	DATE	CHECK No OF MOLDER	CASTINGS MADE	BAD CASTINGS	CASTINGS SHIPPED	LABOR COST
7/10/14	4	54	4	60	2 00												

FIG. 4. BLANK FOR GENERAL SUMMARY OF LABOR.

ELECTROPLATING.

An interesting review of the present status of electroplating was given by Dr. W. Pfanhauser, of Leipzig. He estimated that purely for electroplating work in Europe alone, 2,500,000 amperes are in use, and in the whole world 3,000,000 amperes. This corresponds to 15,000 tons metal deposited per year in electroplating (not including electrolytic refining). Thirty-five per cent. of this work is done in Germany and Austria.

Besides nickel plating, zinc plating is now coming to the front. For zinc plating of wires, ribbons, and tubes, 300,000 amperes are now in use. The main interest of progressive electroplaters is at present directed toward improvements in mechanical appliances. But fundamental changes in the chemistry of electroplating may also come and the author thinks that the next chemical revolution will be the use of fused electrolytes.—Metallurgical & Chemical Engineering.

BRASS IN ENGINEERING CONSTRUCTION*

A Description of Serious Defections Discovered in Material Used in the Catskill Aqueduct of the New York Water Supply System.

By Alfred D. Flinn.†

For many years hydraulic engineers and manufacturers of equipment and materials to be exposed to water and atmospheric moisture have sought a strong, incorrodible, moderate-priced metal or a method of rendering iron and steel greatly resistant to corrosion. Incorrodible iron has not been commercially produced, although some progress has been made, especially with nickel alloys of iron. Alloys of copper with zinc, tin, nickel, aluminum and other metals, in various combinations, have long been used for numerous purposes. Indeed, some of them are among the most ancient of useful metals. Due to incorrodibility and other good qualities, many of them have been in wide demand in spite of relatively high prices and low strengths as compared with iron and steel. For about forty years, however, several kinds of forgible copper alloys have been produced having high test strengths, for which very broad fields of usefulness seemed open in engineering construction. These alloys have been commonly known as bronzes or brasses.

To give information concerning some unusual and troublesome experiences with so-called bronzes and to aid in preventing such troubles in future are the principal purposes of this paper. It is not pretended that it is an exhaustive treatise. At the outset the author disclaims being a metallurgist or having any special knowledge of these metals except as a civil engineer user, and an investigator perforce of circumstances. In large part the investigations to be described have been carried out under the author's general supervision by Mr. Ernst F. Johnson, engineer inspector of the Board of Water Supply. Assistance has been given and is being given by several manufacturers and their metallurgists and especially by the Bureau of Standards, Department of Commerce, Washington, under the personal supervision of Dr. George K. Burgess, chief of the Division of Metallurgy.

Copper-zinc alloys of many variations in chemical composition and physical characteristics are widely used for engineering purposes, and in the arts. Some are commonly called brasses and others are commonly designated as bronzes, but there is no scientific or well-defined basis of distinction. Besides copper and zinc, these alloys in many instances contain small quantities of one or more other metals. In general, those copper-zinc alloys commonly used for mechanical, electrical and civil engineering purposes, should be called brasses, even many which are designated by the trade as bronzes, such as manganese bronze and Tobin bronze. . . .

Many of these alloys have most desirable qualities, among which their great resistance to corrosion and the ease with which they can be cast, wrought and machined, are of leading importance to the hydraulic engineer. Recent advances by the makers of these alloys have produced brasses for which strengths equaling those of steels are claimed; some of these brasses can be cast, forged, rolled, spun, drawn and extruded in a great range of sizes and shapes. For many of these it has been claimed that they could be used as steel is used. In spite of costs several times those of irons and steels, these brasses have been used in large quantities. Millions of dollars have been invested in plants for their manufacture.

Claims of the brass, or bronze, makers, backed up by tests and experience, led the engineers of the Catskill Aqueduct, after careful investigation, to adopt some of these copper-zinc alloys for extensive use where their non-corrodibility and other good qualities claimed for them, made them especially suitable. It is safe to say that on no other single engineering enterprise have such large quantities been used, the total being nearly 3,000,000 pounds. Of castings, ranging from a fraction of a pound to 22,000 pounds each, there have been a total in excess of 2,000,000 pounds; of forgings, a large proportion of the remainder, varying from small bolts to sluice-gate stems about 6 inches in diameter, 31 feet long, weighing 3,200 pounds apiece. Plates, rods and shapes make up the balance. Manganese bronze constitutes a very large proportion of the total; "naval brass," including Tobin bronze, was used in large amounts; various common brasses and special compositions make up the relatively small remaining quantity. . . .

It is not with the large brass castings, which are so important, nor with the large forged stems of sluice gates and valves, nor with the smaller castings, excepting a few cast bolts, that the interesting and trying subsequent experiences have been had. Designing, casting, forging, machining, testing and installing these large objects have involved the solving of many interesting problems, but the unexpected metallurgical developments have occurred in the smaller objects, such as bolts, ladders and pipes, which when they go wrong, have capacities for trouble quite disproportionate to their sizes.

These numerous and various brass articles have been made by a number of manufacturers scattered through New England, New York, Pennsylvania and New Jersey. Their methods and equipment were of their own selection with very few exceptions and apparently were developed by experience. Some of these manufacturers of brass or bronze have had experience equalling or exceeding, in number of years, the period of manufacture of modern steels. Consequently, the troubles which have occurred so extensively on the Catskill Aqueduct have been all the more astonishing, and lack of information concerning such troubles the more incredible. Not alone the Board of Water Supply, but other users have also had trouble of one kind or another, but knowledge of such trouble has come to hand only within relatively recent time. Just when, as to date or in the state of development of brass manufacture, these troubles began, or how extensive they have been, has not yet been learned. Possibly, they might still be considered occasional or accidental, but for the large and concentrated use of these alloys on the Catskill Aqueduct under such supervision as led to the detection of the difficulties and a thorough investigation of their causes, together with their bearing upon the use of such alloys in engineering construction.

Recognizing the great importance of the Catskill Aqueduct as one of the permanent principal units of New York's water supply system, and believing that its relative importance would increase as the years passed, the engineers determined at the beginning that the most durable materials and forms of construction were required both for security and for ultimate economy. Consequently, when designing sluice-gates, valves, ladders in gate-chambers and aqueduct manholes, anchor bolts and other important parts which had to be of metal and would be exposed to corrosive conditions, and for which dependability and durability were essential, bronzes (brasses) of various kinds were extensively adopted. Inquiries were made of other users of these metals, of prominent

*From a paper read at a meeting of the Municipal Engineers of the City of New York, November 25, 1914.

†Deputy Chief Engineer Board of Water Supply of the City of New York.

manufacturers of long experience, and of specialists, and literature was looked up. No suspicions of definite troubles were developed until the fall of 1913, when numerous bolts and rods were found cracked. The number and character of the failures detected strongly suggested that they were more than accidental or sporadic.

Failures were the more disturbing because the specifications had been drawn carefully, in the light of information then in hand, and practically all the metal accepted had been subjected to careful inspection, including the standard physical tests and chemical analyses. Much of the metal accepted had shown physical qualities in generous excess of the specified requirements. It is quite unthinkable that the manufacturers were not honestly endeavoring to fulfill the specifications and furnish satisfactory materials, although they may have been misguided as to means and methods in some instances, and somewhat influenced by commercial considerations. What, then, was the root of the matter? It is the answer to this question which is still sought. . . .

SEASON CRACKING OF BRONZE PARTS.

Defects in large plates, in bolts, rods, side-bars and rungs of ladders and in similar objects constituted the most important lots of failures on the aqueduct. Many of these articles had not yet been installed, but had been in storage, in some instances, for many months. These defective pieces all had cracks, usually circumferential, part way or all the way around. Some cracks were very fine and only superficial; others gaped open and penetrated the metal deeply. In some cases, the whole or nearly the whole cross-section was affected in bolts from ½ to 2¼ inches in diameter; some were found severed, and others broke with a light blow or pull. Specimens which on first examination seemed free from this cracking, developed it later; two or three years have passed in some cases before the defects developed so as to be detected. Investigation disclosed the fact that similar defects had been observed by others in a variety of metals, but chiefly in drawn or otherwise cold-worked brasses. Although not then satisfactorily explained, this trouble was known among brass men as "season cracking."

VARIOUS TESTS WERE APPLIED.

Engineer Inspector Johnson, in charge of the Catskill Aqueduct laboratory, made experiments which demonstrated that improperly cold-worked rods (*i. e.*, cold-worked rods as customarily furnished by a number of manufacturers, at least), were in a state of initial stress and that these stresses were frequently of important magnitude; consequently, in many cases a small or moderate increment of stress, like temperature change or load, would produce failure. By several kinds of tests, surface of rods were shown to be in tension and their interiors in compression, generally as the result of cold drawing through dies. These stresses and their corresponding strains were measured with close approximation in a number of specimens.

In one set of experiments, lengths of round brass rods, 6 inches long, with ends cut normal to the axis, were very accurately measured with micrometer calipers at three equidistant points around the circumference. By turning in a lathe, the diameter of the central portion of each rod was then reduced slightly for a length of 4 inches, and another set of length measurements made. As the turning proceeded, reducing the diameter each time ⅛ inch, successive measurements showed small increments in the length of each rod. This process was repeated until each rod had been reduced to a shape resembling a spool, leaving only a core of small diameter and no further elongation taking place. Thus the core of the rod was shown to have been in compression and the outer portion in tension, and the magnitude of these stresses could be computed from the changes in length. Subsequently, it was learned that almost identical experiments had been performed by Martens and Heyn, the eminent German physicists, and described in their recently-published book, "Materialenkunde."[1]

Converse tests were also made by gradually boring out the cores of rods and measuring the contraction of the shell, by these investigators.

Martens and Heyn also developed a method for determining the tendency of brass to crack by applying a solution of a mercury salt to the surface of the brass rod under initial stress. Cracks would be developed almost instantaneously or in a few minutes in some specimens, while in others the cracks would not become apparent for a number of days. This mercury test has been used extensively by the inspection division of the Board of Water Supply. It has been useful but not infallible; that is to say, some rods which, within a reasonable period of observation, developed no indication of cracking after the application of the mercury solution, subsequently cracked, or other rods of the same lot cracked. Manifestly, it would be impracticable to apply the mercury solution to the whole surface of every rod of a large shipment, and then, after waiting a number of days, to examine all these surfaces closely for fine cracks. Irregularities in stress in different rods of the same lot, and in different parts of one long rod, due to the nature of the manufacturing process, make testing by samples insufficient for important work. Hence, a more practical test is desired by which one can make sure that brass rods or other articles being purchased or already in place are permanently free from the tendency to crack.

The schleroscope[2] has also been used by the board's inspection division since the trouble with season cracking developed. . . .

Cold-rolled and cold-drawn brasses have harder surfaces than the metal which has been worked hot, or that which has been thoroughly annealed. Hence the schleroscope has been a means for detecting whether a specimen of brass had been cold-worked, or whether it has been subsequently annealed. It is useful but alone is insufficient to discover whether a given lot of brass is or is not subject to deterioration of the kinds mentioned in this paper.

After the discovery of the extensive season cracking and a partial investigation of its causes, it was decided to use plain extruded or hot-rolled rods wherever practicable, and to anneal all material which had to be drawn or rolled cold. It was hoped that by these methods of manufacture further trouble of this kind would be avoided, but, unfortunately, this has not proved to be the case. Plain extruded, hot-forged and annealed brass rods, supposedly free from initial stress, have also failed in disturbingly large quantities.

Some experiences and observations indicate that corrosion has much to do with the cracking of brass under some circumstances. Apparently certain kinds of corrosion greatly reduce the cohesion of the affected part of the material, thus destroying the ductility so that cracks develop as soon as the deformation extends to or beyond the yield point. If this conclusion be true, it should be possible to produce season cracking in bars free from any appreciable initial stress by stressing them by means of any external force and then corroding the surface. A series of tests was therefore made in the laboratory of the Board of Water Supply. A number of 1-inch bolts 6 inches long were turned out of pieces of the following

[1] "Initial Stresses in Brass Due to Cold Working." THE METAL INDUSTRY, February, 1914.

[2] "The Schleroscope." THE METAL INDUSTRY, August, 1910.

materials: Cast manganese bronze from two of the most prominent foundries producing this material, plain extruded manganese bronze, rolled and drawn manganese bronze about ten years old, two well-known brands of naval brass, one drawn, the other plain extruded, and one piece of plain extruded Muntz metal. The central 3½ inches of each bolt were turned down to about ¾ inch. Each bolt was put into a piece of double extra heavy steel pipe 3½ inches long and drawn up until it had stretched several hundredth parts of an inch; that is, considerably beyond the yield point. Strong ammonia was then poured into the pipe sleeves through small holes drilled for that purpose. When these bolts were tested with a wrench two days later they were all found to be greatly weakened, and when examined after being pulled apart it was seen that the weakening was due to cracks similar to those of season cracking. In some cases these cracks had penetrated only a short distance from the surface, while in other cases they had affected 80 or 90 per cent. of the cross-section. In some cases only one crack had appeared, while in other cases the entire length of the specimen had developed cracks. Similar results have been obtained with copper bolts.

An additional bolt of plain extruded manganese bronze was similarly treated except that a mercury salt solution was substituted for ammonia. This was found broken. That portion of the surface which had come in contact with the liquid was full of cracks, while those portions of the bolt which had not been touched by the solution were free from cracks. Three other bolts of the same material, strained in the same way, but not exposed to any corroding liquid, were not broken when tested two months later. Tests on pieces of some old corroded brass rods showed that they could stand bending only 45 to 80 degrees before breaking, while other pieces of the same rods could be bent 160 degrees to flat on themselves without breaking, after they had been cleaned with emery cloth.

This indicates that brass, especially when subjected to a tensile stress approaching the yield point is liable to intergranular oxidation which may penetrate indefinitely along certain planes of weakness. This opinion is confirmed by the appearance of the breaks which indicates that the metal is not torn apart as in a tensile test, but parts gradually along the boundaries of the grains, which are supposed to be groups of very small and intimately mixed copper, zinc and tin crystals.

Troubles with brass, or bronze, experienced on the Catskill Aqueduct, may be classified as follows: *First*, breaks from stress, (a) initial stress, due to methods of manufacture or fabrication, (b) applied stress, due to use; *second*, damage by wrong heat treatment, as in forging, bending, flanging, upsetting and annealing. Damage of the second class results entirely from lack of skill, knowledge or care on the part of the manufacturer or fabricator.

Designers have been misled to some degree by the representations of the manufacturers that certain bronzes (brasses) possessed great strength and other excellent qualities, and in some cases would perform practically the same duty as steel, or a little more. Seemingly both maker and user have misinterpreted the results of the usual standard laboratory tests, from lack of knowledge of characteristics of the copper alloys not revealed by such tests. Experience on the Catskill Aqueduct indicates that the bronzes (brasses) as supplied under contract, with careful inspection following the established methods, would not perform the expected duty. Indeed, as these investigations have proceeded it has become evident that the engineer's present necessity is not merely an explanation of certain failures of brass, but a fundamental knowledge of the physical characters and capacities of this group of alloys—knowledge which will be a safe and dependable guide in their manufacture, inspection and use.

To summarize the Catskill Aqueduct experiences: Large numbers of brass bolts have been found cracked and broken in their packing case after storage through a winter, but having never been stressed; others never exposed to low temperatures and never stressed have been found in similar condition. These bolts ranged from ½ inch to 2¼ inches in diameter. Similarly, flat bars, rolled plates and long rods supporting only their own weight have been found cracked or severed after a lapse of a few or many months. Flanged ¼-inch plates riveted together, after careful inspection being in apparently good condition, were found some months later to have incipient and well-developed cracks, while many rivets cracked or yielding to relatively light blows from a hand hammer. Many upset bolt heads have come off. Hundreds of bolts have broken under tension, after short or long intervals. The failures have been so numerous and important as to have caused the gravest apprehension and led to the substituting of steel for brass in many cases, in spite of the recognized disadvantage of steel as to corrosion which the engineers had sought earnestly to avoid. Manganeze bronze, naval brass (including a well-known bronze and its imitation) and Muntz metal, have all failed. Hitherto castings and large forgings have been exempt, or at least failures in them have not been discovered, except in a few cast bolts and nuts.

For the designing and constructing, civil and mechanical engineers, the following questions should be satisfactorily answered, if they are to continue the use of these brasses or bronzes for important purposes:

Can a brass or bronze of high tensile strength be reliably produced which can be used safely for important permanent structures in such parts as bolts and other rolled, drawn, extruded or forged shapes?

What should be the specifications for such brasses or bronzes?

What inspection methods and tests should be used?

By what tests can the tendency to subsequent failure be detected at any time after manufacture?

What working stresses may be used safely for these various alloys?

Will these brasses, or bronzes, deteriorate by reason of constantly applied or frequently repeated stress; *i. e.*, will they fail from fatigue?

[Mr. Flinn's paper was well illustrated with pictures of the large manganese bronze castings used in the water supply system. As most all of these castings have been described and illustrated in THE METAL INDUSTRY, we have not reproduced them here. Articles treating of these gigantic bronze castings appeared in the following issues of THE METAL INDUSTRY: July and September, 1913, and February and May, 1914. Attention is called to replies to this paper by W. P. Smith and N. W. Schwenk, of William Cramp & Sons Ship and Engine Building Company, Philadelphia, Pa., published on page 517 of this issue of THE METAL INDUSTRY.—ED.]

AID FOR CHILE.

The financial situation is extremely critical with prospects of early ruin unless war ends soon with restoration of nitrate market at a fair price. United States can assist by taking heavy shipments of nitrate from this district and copper and silver ores and Bolivian tin ores from Antofagasta, and opening branch banks, extending credits, and investing additional capital in enterprises elsewhere.

ALUMINUM DIE CASTINGS*

SOME SIDELIGHTS ON THE PRODUCTION OF FINISHED METAL PARTS.

BY A. B. NORTON.†

The term "die casting" is used to designate a type of castings which are made in permanent metallic molds. As such, it embraces a wide variety of work which is assuming more and more importance. The development of the industry is proceeding so rapidly that producers and consumers in general lack definite information as to the alloys used, or the advantages, possibilities and limitations involved. Four main classes of alloys are now in use. The bases of these alloys are namely (1) zinc, (2) tin, (3) lead, (4) aluminum.

The zinc, tin and lead base alloys are low melting and of low shrinkage. The problems involved in making them were therefore attacked early and castings of this type have been on the market for some time. They are mostly small parts used in places where they are not required to possess much strength or rigidity and, as such, when properly made, they serve the purpose for which they were intended very well. The lack of strength, the low melting point, and heavy weight (with its consequent cost) of these alloys, have made aluminum die castings very desirable, but the difficulties involved in their manufacture have retarded the development of the industry to such an extent that at present the Aluminum Castings Co. has the only plant in America in which the manufacture of large aluminum die castings is being carried on commercially.

The principal difficulties met with are (1) the high melting point of aluminum (as compared to tin, lead and zinc), (2) the tendency of molten aluminum to absorb iron, (3) the relatively high shrinkage on solidification, and (4) the weakness at the solidification point developed by aluminum when burned or soaked.

The first two features mentioned have hindered the direct adaptation of pressure machines of the iron plunger type, since certain parts of these tend to wear out rapidly, due partly to solution of the iron or steel in molten aluminum, and partly to oxidation about the heat source.

The high shrinkage on solidification and the weakness of burned or soaked aluminum during that period, have been fruitful sources of trouble in the form of cracked castings. Some attempts to remedy the shrinkage have been made by using alloys developed for that purpose. An alloy of about 7 per cent. cadmium with a small percentage of manganese, was evidently designed with this purpose in mind. The manganese, though beneficial in a different way, would tend to lessen the advantage gained from the cadmium. About 2 per cent. of tin has likewise been added to an 8 per cent. copper alloy. This tends to help by causing the aluminum to stretch rather than crack, but its effect is not so apparent in a well designed mold.

Zinc is a common and useful hardeneing element for aluminum castings made in sand, but its use in die castings is prevented by the hot shortness of zinc-aluminum alloys. It is not unknown in the field, but it is extremely difficult to handle. The alloy used almost entirely by the Aluminum Castings Co. is practically No. 12. (Aluminum 93. Copper 7 parts.) This particular composition is desirable from many viewpoints. It can easily be prepared without overheating any portion of the component metals. It is strong while solidifying, strong at high temperatures, and also at ordinary temperatures. The practice has been perfected with the use of it, and a change in the alloy would necessarily mean some revision of methods and manipulation.

The process of manufacture of aluminum die castings is difficult to describe, since each job is a problem of its own and must be worked out individually. The molds are made of iron. They are constructed in sections containing a large number of loose pieces, the number varying, of course, with the size and complexity of the casting. The loose pieces serve several purposes. They may be used as cores, as chills, or to form projecting parts which otherwise would interfere with the opening of the mold.

The operation in brief, then, is to assemble the mold, heat it to the proper temperature, insert the cooling pieces and pour the casting. The loose pieces are then removed in the proper order at the proper times, and the die is taken apart for removal of the casting. In order to get more complete control of the operation, most of the molds now in use are mechanically operated. The method of mechanical control we are not at liberty to discuss.

It is evident from the preceding description that the aluminum die castings must be made in molds which are a perfect machine fit. The mechanics employed must be of the highest class. The mold itself will not work at all unless very accurately constructed. The castings produced must therefore conform to this same high standard of perfection, as to dimensions.

The accuracy attainable in the making of an aluminum die casting results in a considerable reduction of the number, extent and expense of the machining operations required. It is possible to meet dimensions in most cases with a very slight variation. The necessary allowance for finish is therefore, in many cases, zero, and, as a consequence, the customer gets a casting of the minimum weight consistent with his requirements. Since the castings are all alike, they fit the jigs accurately and readily, thus saving time and increasing the accuracy of the necessary machining operations.

The metal used in die castings has to be handled with the greatest of care, and, in general, does not come in contact with any sand. Consequently, sand inclusions and hard spots cannot be present to dull tools or knock them out of alignment. The molds impart to the metal a very smooth surface and an exceedingly close grain. This fine grain takes a brilliant polish readily and rapidly. It is also practically impervious to water and oil, due to the fineness of structure, combined with the freedom from dross and dirt.

Comparative figures of the physical properties of die castings and sand castings follow:

	Sand Castings	Die Castings
Tensile Strength	20,000*	25,000**
Approximate Elastic Limit (Stress for .01" elongation in 2")	13,000*	13,000**
% Elongation in 2"	1.7*	3.1**
Specific Gravity	2.84	2.87

* Average of hundreds of bars.
** Average of 48 test bars.

The above table shows that aluminum die castings are much stronger than the sand castings, and, in fact, pound for pound, they exceed cast iron and ordinary brasses and bronzes.

The high strength, resistance to heat, light weight and beautiful color of the aluminum permanent mold prod-

*A paper presented at the annual meeting of the American Institute of Metals, September 7-11, 1914, at Chicago, Ill.
†Aluminum Castings Company, Cleveland, Ohio.

ucts have caused their adoption already in numerous classes of work. This includes many types of electrical, scientific and measuring instruments, cash registers, automatic vending machines, typewriters, adding machines, cooking utensils, automobile and aeroplane parts. One of the newer adaptations is in the manufacture of pistons for automobile engines. Die cast aluminum pistons were used successfully in most, if not all, of the French racing cars in the recent 500 mile event at Indianapolis.

The process, like any other, has its limitations. Getting a job under way involves a considerable expenditure and hence prevents the acceptance of small orders. The design and preparation of the dies is an expensive process and usually the casting desired has to be altered somewhat to adapt it to this form of manufacture.

The process in America at present is limited largely to pieces in which the coring can be designed so as to permit the use of metallic cores. In France large oil pans have been made in which sections almost entirely enclosed were obtained through the use of sand cores. Some pieces are being made here with sand cores, but it is far preferable, where possible, to redesign a job so as to obtain all of the advantages afforded by all metallic molds.

The production of commercial castings, as outlined above, is not a mere matter of getting a certain mysterious machine adaptable to all purposes and setting it to work On the contrary, each individual job requires a separate solution. Here the first big factor is the experience of the engineer who designs the mold. He requires also the co-operation of the engineer who designed the casting, in order that changes required will be made whenever possible. After the mold is made, the best conditions for operation must be determined and the operators must be trained to handle them. This experimenting is necessarily extremely expensive, and would be prohibitive but for the high production obtained from a mold once it is in working order.

The process as described contains features which may be profitably adapted to brass die casting work, but our experiments in this particular are incomplete as yet. Castings weighing about 30 pounds each are now being turned out in large numbers. These in general replace sand castings weighing about 25 per cent. more. An iron sand casting of the same volume would weigh close to 100 pounds and would be only about 30 per cent. stronger. Aluminum die castings will therefore solve many manufacturing problems and their obvious advantages assure their adoption in many lines of industry.

THE VALUE OF A FOREMAN IN A BRASS MANUFACTURING PLANT

A Few Suggestions as to How a Foreman Can Increase His Efficiency.

By P. W. Blair.*

On a recent visit to a brass manufacturing plant of a well known firm I was required to wait a considerable time for the foreman. When at last he appeared he was carrying a box of rough castings from the foundry. After he deposited the castings on the floor and wiped the perspiration off his forehead and greeted us, it occurred to me then that his time and talents could have been more profitable to the company if he had been engaged in a less laborious task.

A foreman with forty to fifty employees to look after in a brass manufacturing plant should not employ his time in delivering castings. He should be a person who has proven his efficiency in skilled and unskilled labor to such an extent as to be the right person to act as a director of his apportioned work and superintend it. If this directing be thoroughly and properly done the foreman, no matter how active or muscular he may be, will have little time to devote to the work of a truckman or hustle castings around. It is an extremely wrong and short-sighted policy of a management to load a first-class mechanic and disciplinarian, as the foreman should be, with a quantity of clerical and laborious work.

There are a number of systems which have been installed in brass manufacturing plants within the past few years to reduce the cost of manufacture, and which require many foremen to devote half of their time at the task of departmental and cost clerks. There are, of course, many instances where it is less trouble to do a job oneself than it is to explain its ins and outs to others, but this is often due to the fact that the foreman is not practical in doing the latter.

The cost of a mechanic is considerably less than that of his foreman. That of a good clerk should be about one-half and that of a boy about one-sixth. If he does the work usually allotted to any or all of the classes above mentioned the management is inclined, in nearly every case, to hold a poor opinion of him. A period of self-assertion on his part in adhering to the policy of delegating these tasks to the proper persons will enable the foreman to find a wonderfully large number of ways in which he can be useful to his firm. He can study the temperament of each man and govern him accordingly in order to get results. He will also find that he can think of several things at once, even to the different methods of handling and operating the production and that this forethought will make many of the fatiguing tasks which he allotted to himself unnecessary. He will be prepared for any emergencies which may develop, though they do not come often if taken in time, that can be turned to great benefit for himself and the firm.

It is a well-known fact that a physically tired man has not the nerve force necessary to govern workmen to the best advantage or to retain their greatest respect. The admiration of a man is seldom gained by doing something that he considers beneath his own dignity or that he can do as well himself. The foreman in the foundry, finishing, polishing and nickel-plating departments of a plant will find it much to his advantage to cultivate those attributes which he considers essential.

If he has keen perception of possible economies, promptness in dealing with exigencies, firmness and fairness in discipline and alertness in dealing with the firm; also reducing the cost of production and improving the quality of the product, he is more likely to impress the firm with his qualities as a foreman than by a personal exhibition of muscular ability.

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NICKEL MINING IN CANADA.

The importance of Canada's nickel mining industry may be more fully realized when it is considered that Canada produces over eighty per cent. of the world's output of nickel. In 1913 the Copper Company's smelter at Copper Cliff, in the Sudbury district, treated 665,000 tons of ore, containing over 44,000,000 pounds of nickel, or about ninety per cent. of the total output of Canada. The nickel was recovered as matte and shipped to the United States for refining.

In 1913 Canada exported 43,341,307 pounds of nickel, contained in ore or matte, to the United States and 4,826,732 pounds to the United Kingdom

DETERMINING WEIGHT OF DEPOSIT.

SOME VALUABLE SUGGESTIONS FOR THE CHEMICAL DETERMINATION OF ELECTROLYTICALLY DEPOSITED METAL.

BY L. C. WILSON.

(Concluded from August.)

NICKEL.

Nickel possesses so many excellent physical and chemical properties, that it finds a very wide application in electro-plating. It is so easily deposited and presents such a splendid appearance when buffed, retaining this even under adverse conditions, that it is of great value for application where appearance is an important item. And aside from all this, it affords such efficient protection from corrosion that it may be used in almost any case where both appearance and protection are desired.

Nickel, in many ways, markedly resembles iron. It is silvery white in color and quite lustrous, when pure. Hard and heavy it melts at about the same temperature as iron; although when alloyed with other metals, the fusing point may be lowered. In common with a number of metals it exhibits a slight magnetism at ordinary temperatures, but this disappears when it is heated short of dull redness.

As far as its chemical properties are concerned, nickel is soluble in dilute nitric acid and dissolves very slowly in both hydrochloric and sulphuric acids. Strong nitric acid produces the very peculiar phenomenon, known as the passive or inactive state, in which it is quite insoluble in the dilute acid. Just what action takes place may be open to some question, although it is probable that the metal receives an electric charge.

Nickel may be estimated in a number of ways and perhaps the simplest makes use of an organic compound known as dimethylglyoxime.* The nickel is precipitated in a solution containing a slight amount of free ammonia and comes down as a bulky precipitate of a splendid red color, which is filtered off, washed, dried at 212 degs. F. and weighed. The manipulation is so easy and the results so accurate that it is a most useful method. The only equipment required is a balance, the reagent and a Gooch crucible, with some finely shredded asbestos, which may be obtained at any supply house. A saturated solution of the dimethylglyoxime is made in 85 per cent. grain alcohol.

The suction pump is connected to a water tap and then to the filtering flask by a piece of thick-walled rubber tubing. The filter tube is run through a rubber stopper, which fits the flask. A piece of large bore rubber tubing is then slipped over the funnel end and allowed to project up over the edge of the glass about two and one half inches. When the Gooch crucible is forced down into it a short distance a tight connection, preventing leakage of air, is thus formed.

To prepare the crucible, it is thoroughly cleaned, inside and out, then placed in the filter tube and the asbestos, which should be shaken up with water to form a heavy suspension, poured through it until a compact layer is formed on the bottom. It is best to use only a moderate suction at first. For this particular analysis the mat does not have to be very thick, since the precipitate is so bulky that there is little danger of it running through. As a suggestion, the layer of asbestos should be as thin as consistent with good work, as the thinner it is, the quicker it filters. Ordinarily, it should be about one-sixteenth inch or over.

After the mat has been washed with distilled water several times and dried as thoroughly as possible by suction, the crucible should be dried for an hour at 212 degs. F., then placed in a desiccator or under a beaker until cool and weighed. It should be re-dried and weighed until a fairly constant weight is obtained. It must be borne in mind that incorrect results are generally obtained when articles are weighed while very warm; also, that asbestos and many substances tend to absorb water very rapidly and increase in weight upon exposure to the air after drying. Therefore, weighings should be made as soon as the objects have cooled nearly to room temperature, while covered with a beaker.

In order for the operator to gain confidence and assure himself that his manipulation is sufficiently skillful to give accurate results, it will be a good idea to make up a solution of a nickel salt, containing a known amount of metal and then go through the analysis on a few cubic centimeters of it. It will then be easy to compare the weight of nickel actually found with the theoretical weight; they ought to check very closely. For this purpose a solution of nickel sulphate, $NiSO_4$, $7H_2O$ or nickel ammonium sulphate, $NiSO_4$: $(NH_4)_2\ SO_4$. $6H_2O$, known as single and double nickel salts, respectively, should be prepared.

Weigh out accurately .4786 g. of nickel sulphate, and dissolve in a small quantity of distilled water, about 50 c. c. Pour the solution into a 100 c. c. volumetric flask and add distilled water to the mark on the stem. Each cubic centimeter of this solution contains .0048 g. nickel sulphate, $NiSO_4$: $7H_2O$, which is equivalent to .001 g. metallic nickel, since the salt contains 20.89 per cent. of this by weight.

To determine the nickel, clean out a 10 c. c. pipette by drawing it full of distilled water two or three times, then rinse out with a small quantity of the solution to be tested, contained in a separate beaker. Now measure off ten cubic centimeters of solution in the pipette by drawing up such a quantity that the column rises a little higher than the graduation mark around the stem. Remove the pipette from the mouth and place one finger tightly over the end. This must be done very quickly, but a little practice will be sufficient to acquire the knack. By slowly releasing the pressure of the finger the liquid can be allowed to run out drop by drop until the lowest part of the curved surface coincides with the graduation mark. Any excess of liquid at the end of the pipette should be drained off by touching it to the side of the beaker or flask containing the solution.

The pipette is then discharged into a clean beaker and about 60 c. c. distilled water added. In the analysis of a solution in which much iron is present, it is a good idea to add .3 or .4 g. of tartaric acid, at this point, in order to keep the iron from coming down when the ammonium is added, although, of course, it is not necessary in this particular instance, as the solution does not contain iron.

The solution should be heated nearly to boiling and the alcoholic solution of dimethylglyoxime added, a few drops at a time, with constant stirring, until the nickel is completely precipitated, which is shown when a drop produces no further action. Ammonia is now added until the solution has a slight but distinct smell of it, the whole allowed to stand a few moments, then filtered through a Gooch crucible which has been previously prepared and weighed as described above. The precipitate should be washed several times with hot water, taking

*See article by P. S. Brown "Determination of Nickel by Dimethylglyoxime." THE METAL INDUSTRY, August, 1913.

care not to tear up or disturb the asbestos mat, and the crucible finally dried at 220 degs. F. for an hour. It should be allowed to cool in a desiccator or under a beaker and then weighed.

The increase in weight of the crucible over the previous weighing is due to the red precipitate, nickel dimethylglyoxime, $(CH_3)_2C_2(NOH)_2$. This has, therefore, a molecular weight of 288.83 and contains 20.31 per cent. nickel, and multiplying the increase in weight by .2031 gives the weight in grams of metal present in the 10 c. c. of solution taken for analysis.

An example may make this clearer. Suppose the following data was taken:

Weight Gooch crucible + precipitate..	15.8963
Weight Gooch crucible	15.8503
Weight precipitate	.0460

As noted above this precipitate contains 20.31 per cent. nickel, therefore, $.0460 \times .2031 = .0093$, which is the weight of metal found in 10 c. c. of the solution. The latter was made up, however, so that 10 c. c. actually contain .01 g. of nickel, so our determination is sufficiently close.

We are now in position to undertake the work for which all of the foregoing has been merely a preliminary, namely, the determination of the weight of nickel which is actually being applied in practice. This might be conveniently and easily done by weighing any desired part, plating it and weighing again and noting the increase in weight, if it were not for the fact that there are very few parts plated on which the deposit is of uniform weight over the entire surface. Due to irregularities of shape, and other conditions in a plating bath over which the plater has no control, certain surfaces almost invariably receive a heavier coating than others. For example, surfaces which are at right angles to the anodes, receive a much lighter deposit than those which are directly in front of them. Various schemes are tried to obviate this condition as far as possible and many are successful, but most establishments accept this and other problems in much the same way as they do rains, cyclones and other acts of Heaven and make no attempt to evade them.

Therefore the simple expedient mentioned above is not very practical since the total weight of nickel on the part is thus obtained, which is obviously information of little value, as when it is divided by the area of the part in square inches the result is the average weight of metal deposited over the entire surface. As we have seen, the areas of light and heavy deposit in most cases would differ considerably from the average. Consequently, in examining a part, it is best to locate these different areas. This may be done by covering the surface with melted beeswax and after the wax has hardened, cutting narrow strips or channels in it extending clear around the part, or in various directions, depending on the shape, and immersing it in nitric acid, which has been diluted with its own volume of distilled water. The process should be carried out in a glass beaker, so that the action may be closely watched. The acid rapidly removes the nickel coating and the base metal soon begins to show through in different places. These spots, which represent the areas of low deposit may be marked in some way and a pretty good idea of the relative amount of nickel on the various surfaces of the part may be thus obtained.

In removing the beeswax coating, for this test, care should be taken not to cut through or injure the nickel deposit, as this might lead to erroneous results. Ordinarily, a piece of hard wood or tooth pick serves very well; it should cut a path about 1/16-inch. Precautions must also be taken to insure all of the beeswax being removed from the path, since even a very thin film would interfere greatly with the action of the acid and give badly misleading results. A bit of cloth placed on a match or tooth pick and saturated with chloroform may be used to remove the last traces of wax and give a perfectly clean surface.

Tests to determine the actual weight of nickel at any desired place may now be made by carefully removing the wax, and immersing the part in nitric acid, as before. When the nickel has been entirely removed, the solution is evaporated down, if necessary, to a convenient bulk, the free acid almost entirely neutralized with ammonia (tartaric acid should be added previously, if there is reason to suspect that the solution contains iron) then the dimethylglyoxime solution added and the estimation of the nickel finished according to the preceding directions. When it is finished, by dividing the weight of metal in grams by the area of the stripped surface and moving the decimal point three places to the right, the result is expressed as milligrams per square inch, which is the most convenient way of giving it. In removing the wax care must be taken not to scrape away any of the nickel coating, or, of course a serious source of error would be introduced thereby. Also, it may save time, when the shape of the part will permit it, to remove the wax from a spot of definite area, as a square with one inch sides, or a circle one inch in diameter, since the exact area is then known without much measurement or calculation.

By making a number of determinations in various parts of the surface a good deal of valuable information regarding plating conditions may be obtained and some idea gained of the possible remedy. According to the nature of the case, a different method of racking, the employment of anodes curved to follow more or roughly the shape of the parts or even rotation of the latter may be resorted to, in order to produce a deposit of uniform thickness over the entire surface. Further discussion of this point would be out of place in this article. Regarding the weight of deposit necessary for adequate fulfillment of the purposes for which the coating is applied, this will vary according to conditions and perhaps a definite statement can hardly be made.

In the case of iron or steel parts, when protection from corrosion is an important consideration, a deposit of at least ten, or preferably fifteen milligrams per square inch ought to give satisfactory results under ordinary conditions. This must be understood to mean that no part of the surface shall receive less than the weight of metal recommended, therefore, those areas which plate more quickly may get a considerably heavier deposit. In some cases the average weight might be several times the minimum, unless some particular device or expedient were employed to insure a uniform deposit. If no such attempt were made, it might be rather expensive to put on such a heavy deposit of nickel, but in most cases just as good results at less cost may be obtained by first giving the parts say about ten milligrams of copper per square inch and then plating on as much nickel as needed to make the desired weight. In the case of parts subjected to unusually severe service, a total weight of nickel or copper—nickel amounting to forty or fifty or even more milligrams per square inch might be advisable.

When brass or other non-ferrous metal parts are being considered, protection from corrosion does not enter into the question and it is then in most cases only necessary to know if they are to be subjected to friction.

THE ART OF METAL SPINNING

THE SPINNING OR FORMING OF METALS TOGETHER WITH THE TYPE OF TOOLS, CHUCKS AND LATHE REQUIRED TO PRODUCE THE ARTICLES FROM THE METAL BLANKS. THIS ARTICLE BEGAN IN MARCH, 1914.

BY EASY WAY.

(Concluded from October.)

SPINNING IRREGULAR SHAPES.

To show how it is possible to spin metal into irregular shapes, such as columns, etc., a sketch (see Fig. 14) is submitted of an article with both the ends large and small at the central midway portion wherein that part must be spun in the air. Spinning has been previously referred to when it was supported by a stick in the left hand, but at this time there being metal of large diameters at both ends that of course cannot be pursued. Some skill is required and it can be accomplished with comparative ease through practice. Should this be attempted with a solid chuck the articles could not be separated from its chuck other than by the burning process and as this, as well as a sectional chuck, is impractical,

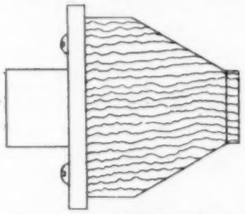
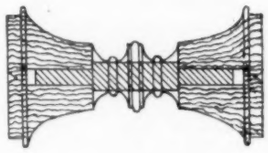


FIG. 14. PRELIMINARY CHUCK.



SPINDLE, CHUCK AND WORK.

due to the small diameter, the sketch can be used as a guide to create a foundation for ideas of other shapes of this character. This may be termed a spindle chuck as for stability a shouldered steel spindle is first produced; then through the blocks of wood center holes are drilled that will fit the spindle. It being shorter and not extending to the outer ends of the wood the regular wood turning centers can be used and the required form finished on centers, after a cylinder has been obtained on a preliminary chuck.

The spindle chuck is separated and the metal cylinder mounted on it and spun on centers to the shape of the chuck ends. The center portion is spun in the air by the skill of the operator pressing the tools carefully

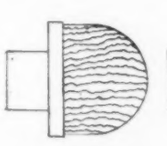
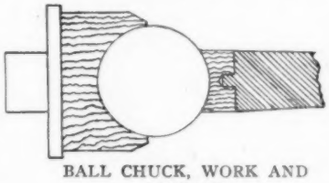


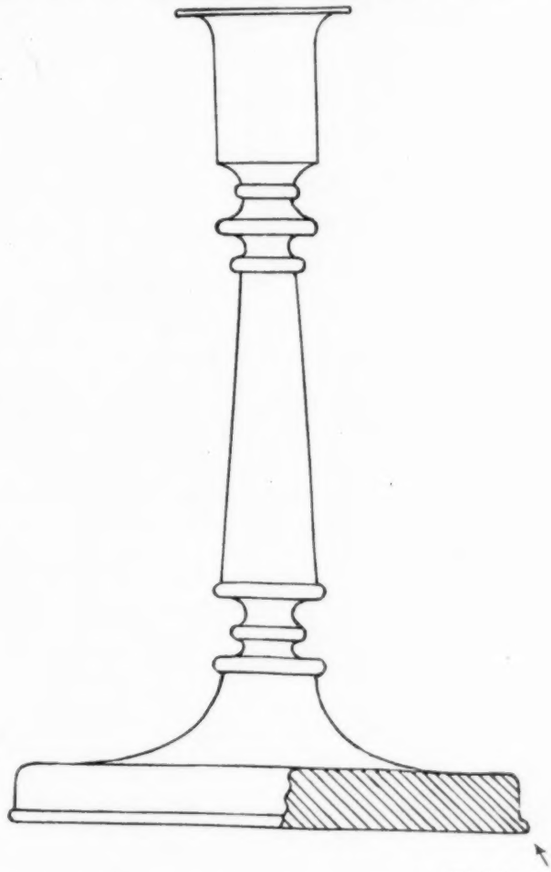
FIG. 15. CONVEX CHUCK.



BALL CHUCK, WORK AND CARRIER.

FORM OF LOCK.

against the metal as it revolves, and with a templet produces the shape required. When finished the tail stock center is withdrawn and the chuck ends removed from the article. Many articles are made up of spun parts then joined together by seaming or solder, as for instance, a ball. There are two ways of making a hollow ball of sheet metal, one is in one piece and the other by joining two spherical thimbles. For practice we will choose the latter. Both styles, however, are started on the convex type of chuck, but the first referred to requires closing tools, whereas the latter, which is in halves plus the required amount of metal for the inward and outward laps suitable for closing (see Fig. 15). After the thimbles are entered into a ball chuck and their edges curled, male and female. The female curl is made by a round nose tool while spinning the metal from the inside outward and forcing it down to blend with the rest of the curved thimble; thus preparing it for its male member which is placed in the same chuck and its edge curled inward with the spinning pliers and a slight shoulder produced for the female half to be pressed against. Then the two are assembled and pressed together firmly by the carrier in the tailstock, and the planisher is used to spin and wipe down the seam which, if too prominent, can be concealed by solder. There are many articles joined together in sections with hard and soft solder. The sections being spun and tied



Block for Insert.

FIG. 16. A COLUMN WITH A BOTTOM INSERT OF WOOD OR CASTING.

with wire are treated with a soldering compound as a flux, and then by the aid of a blow-pipe pellets of solder are caused to melt and flow into the joints or by the sweating process which is accomplished by tinning the parts and clamping them together; then applying heat until they amalgamate. If the solder should sweat outside and cling to the surface it can be readily removed by placing the article in the lathe and by a tool or emery they can be finished smoothly so the joint is hardly perceptible.

When spindler and column articles are produced it becomes necessary oftentimes to load them with materials,

such as plaster of paris or dry sand mixed with resin. This gives them strength and is a preventative of the article being top heavy and this process is called the loading process. After the proper amount of the melted resin or liquid plaster is poured in and is level with the bottom of the article, which is placed in an inverted position to receive and when dry a piece of felt of any suitable color to serve as a cushion base is glued fast and trimmed away. The felt gives a finished appearance to the article and prevents the bottom edge of the metal from coming in contact with any fragile surface.

There are other ways, however, of obtaining this same effect and produce the bottom of the article by spinning the metal over finished wood or castings, but they too should have a felt base. These bottoms are often ornamented with very pretty designs rolled into their surface by a knurl and equidistant lines. The sketch shown in Fig. 16 if it did not have a heavy base would surely be top heavy and will here serve as a study. After the metal

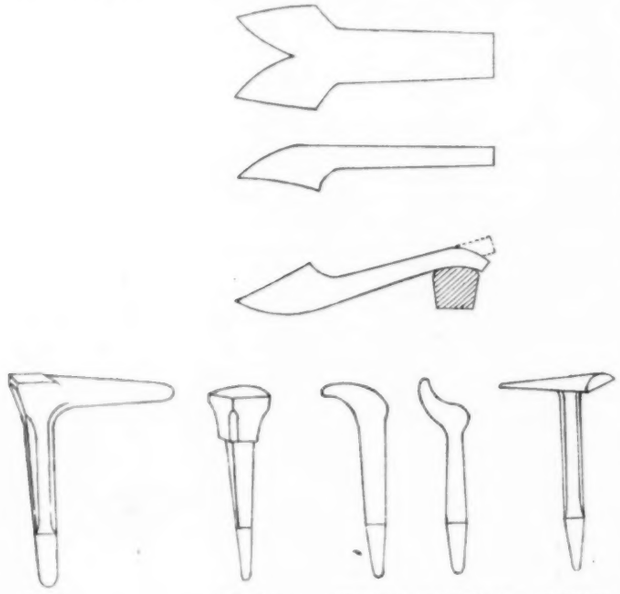


FIG. 17. PRODUCING A ONE PIECE SPOUT AND SOME TOOLS USED.

is spun true to its chuck and smoothed perfectly the metal part is removed, plated and polished then returned to the spinner so that the wood or casting, which has also been finished according to taste, may be inserted and serve as the bottom. To do this the spun section is controlled at its top on a chuck while the other end is governed by a carrier shrouded with thin leather or rotated directly on the tailstock center, which is generally a matter of individual decision. Then the tool rest pin is located in position and the edge of the sheet metal spun tight over the wood or casting. As an ornament a bead may be produced and knurled.

Many articles such as sheet metal handles, spouts and other projections for ornamental purposes on receptacles were made by hand in halves and hammered into shape by mallets previous to the advent of drop and crank press dies by the aid of stakes, mandrels and irons, as shown in Fig. 17, which are very scarce now-a-days. The stakes are made of steel in several shapes and are held by a hole in the work bench for the conveniences of the operator, either in a vertical or horizontal position. The mandrels are also made of steel in many diameters and the irons are as plentiful as the blacksmith's flatters, fullers, etc.

These irons are known by several phrases to produce shapes and the irregularities of any article such as convex, concaves and concavoconvex and are called bead-irons, joint-irons, tongue-irons, creasing-irons, curling irons, sparrow-hawk or beck-iron, etc., also an anvil and a general swage iron. There are also names for the different shapes of mallets and hammers as the pene, squareface, roundface, hollowing, block concave, convex smoothing, setting and planishing together with the regular boxwood mallet and riveting hammer.

To produce a neat and well fitted curve or any other irregular shape to be attached to an article solely by hand tools it requires some skill and patience, and it should be quite interesting to know how the artisans in those days managed to produce shapes of this character. At first such shapes were made in halves roughly cut to shape then hammered and filed to obtain a uniform shape that could be soldered together and attached to a receptacle by a flange which was to fit the intended location. This was the primitive method and after which the idea was conceived to make the shapes of one piece of metal and hammered to shape. The methods then involved were rather crude when compared to our modern appliances. When a quantity of the same shaped article was required the first requisite was a templet or pattern of the finished unit to produce the shape of its blank and by this the finished article was obtained. After the metal was cut to the pattern and rolled over a side and tunnel stake to produce a tube shape, then the curved section was hammered so that the two edges would meet. The now roughly shaped spout was then wired together and fastened with hard solder. Then with the proper shaped hammers and stakes it was made more shapely. After properly shaping the tube was loaded with molten lead so that the spout curves could be produced over the different shaped irons and stakes by coaxing with light setting hammers and at the same time planishing out the irregularities until the surface was smooth. The lead served the purpose as a flexible foundation yet it was of sufficient hardness to withstand the hammer shock and prevent the numerous indentations being seen in the metal which had been subject to pressure and tension. It also enabled the workman to control the springy stubbornness and force it to yield in any shape even though the curves were acute. The lead which possesses little or no elasticity serves its purpose in every respect.

The buckling in metal is generally and chiefly due to unequal annealing and impurities and the elasticity is the property which enables one to stretch or compress metal to its original form. Hence, the thinner the metal is the greater is its elasticity. The spout with its surface smoothed was held over a turning iron and the required radius produced by striking a few smart blows with a wood mallet to obtain the swanneck. After this the lead was melted out and the entire surface of the spout gone over with a fine file; then strapped and polished and it was then ready to be soldered to the receptacle as a tight joint, which was an easy operation if the template was the correct shape.

With this equipment, as above explained, the artisans in olden days produced specimens of art that cannot be excelled even now. However, the present general idea is beauty of simplicity rather than the painstaking assiduous practice required to produce specimens that are exceedingly valuable owing to the patience and labor involved, and for many years past have not been commonly viewed except in the museums of the world where they are encased and guarded as more precious than gold.

THE END.

SOME RECENT APPLICATIONS OF METALLIC COBALT*

A Review of Some Experiments Conducted with Cobalt and Copper Alloys.

By DeCourcy B. Browne.†

For several years the metal Cobalt has been exciting quite some attention in the steel industry for the manufacture of Cobalt high speed tool steels and "Stellite," the former being, in general, an ordinary high speed steel with the additon of about 5 per cent. Cobalt and the latter being an alloy made by Mr. Elwood Haynes, of Kokomo, Ind., containing very high percentages of Cobalt, Chromium, Tungsten, Molybdenum and no iron, and being also used as a tool steel. (cf. Proceedings of Eighth International Congress of Applied Chemistry, September, 1912, Vol. II, Pages 119-123, "Alloys of Cobalt with Chromium and Other Metals.") Very excellent results have been reported of both the Cobalt high speed tool steel and "Stellite," and in view of these successes, many metallurgists have asked, What will Cobalt do in Brasses and Bronzes? And this paper, which the writer respectfully submits to the American Institute of Metals, deals with this question.

On account of the comparatively high melting point of pure Cobalt metal itself, 1478 degs. C. (cf. Reprint No. 205 of the Bulletin of the Bureau of Standards, Washington, D. C., April 25, 1913, p. 8), it was advisable to manufacture an alloy of Cobalt and copper 10/90, which could be very readily handled in mixing, and this 10/90 alloy was used in the tests compiled herewith. A great deal of research work on Cobalt has been done by H. T. Kalmus, S. B., Ph. D. (cf. "Preliminary Experiments on the Metal Cobalt and its Alloys," Annual Meeting of the Canadian Mining Institute at Ottawa, March 5, 1913.) This paper refers to Cobalt ores, Cobalt oxide, reduction of oxide, static and dynamic properties of metallic Cobalt, electroplating of Cobalt, corrosion tests and various other interesting items.

Below are the three Cobalt tests made on:

(1) Manganese bronze.
(2) 88-10-2 metal.
(3) Low brass 80/20.

NO. 1 COBALT TEST, MANGANESE BRONZE, UNDER A. S. T. M. SPECIFICATIONS FOR INGOTS. STANDARD TEST BARS .505" DIAMETER.

Bar No.	Description.	% Cobalt added.	Tensile Strength pounds per sq. in.	Elastic Limit pounds per sq. in.	% Elongation in 2"	Reduction of area %
1	Original Mn Bronze	None	74020	35020	.56	26.13
2	No. 1 remelted and .50% Co added	.50	65530	31160	.82	35.17
1-A	Original Mn Bronze	None	73900	34000	.67	30.50
2-A	No. 1-A remelted, no Co added	None	73500	39500	.72	35.00
3-A	No. 1-A remelted, .50% Co added	.50	63600	30050	.88	41.50

The above tests were made through the courtesy of Mr. G. H. Clamer, of the Ajax Metal Company.

Comparing Bar No. 1 (no Cobalt added) with Bar No. 2 (.50 per cent. Cobalt added), it is noticed that the tensile strength and elastic limit of the treated bar are considerably reduced; yet, at the same time, the elongation and reduction of area are greatly increased.

Comparing Bar 2-A (no Cobalt added) with Bar 3-A (.50 per cent. Cobalt added), both remelts, the treated bar again falls off in tensile strength and elastic limit, but again the elongation and reduction of area are increased.

No. 2 Cobalt Test, 1 in. sand cast test bars, the 9/16 in. bars being machined down from 1 in. Metal poured quite hot. Mixture 88-10-2.

Table No. 1.—First Melts.

Bar No.	Diameter.	% Cobalt added.	Tensile Strength pounds per sq. in.	Elastic Limit pounds per sq. in.	% Elongation in 2"	Reduction of area %
1	9/16"	None	39050	11500	18.5	20.6
5	9/16"	.50	44000	15500	23.0	21.3
3	1"	None	35000	10599	15.6	12.6
6	1"	.50	34725	12300	15.5	18.8

Table No. 2.—Remelts from Table No. 1 in order.

Bar No.	Diameter.	% Cobalt added.	Tensile Strength pounds per sq. in.	Elastic Limit pounds per sq. in.	% Elongation in 2"	Reduction of area %
2	9/16"	None	37800	13400	12.6	13.4
7	9/16"	.50	35200	13000	25.0	29.4
4	1"	None	43000	13500	17.5	17.0
8	1"	.50	31700	12600	10.5	18.4

The above tests were made at the works of one of our largest manufacturers of electrical equipment, whose facilities for testing materials are first class in every particular.

The tests are arranged alternately, with and without Cobalt addition, same size test bar, so as to be comparable, Table No. 1 being first melts and Table No. 2 being remelts of Table No. 1 arranged in order.

Comparing Bar No. 1 (no Cobalt) with Bar No. 5 (.50 per cent. Cobalt added), it is clearly shown that the effect of the Cobalt is to considerably increase the physical properties throughout—tensile strength, elastic limit, elongation and reduction of area. Comparing Bar No. 3 (no Cobalt) with Bar No. 6 (.50 per cent. Cobalt added), the effect of the Cobalt is not quite so marked, nevertheless there is a decided improvement in elastic limit and reduction of area while the tensile strength and elongation substantially remain constant. On the remelted bars, Bar No. 2 (no Cobalt) is comparable to Bar No. 7 (.50 per cent. Cobalt added), in this case the tensile strength and elastic limit remain almost constant, while the elongation and reduction of area are again greatly in favor of the Cobalt-treated bar. Comparing Bar No. 4 (no Cobalt) and Bar No. 8 (.50 per cent. Cobalt added), the treated bar shows a decrease in tensile strength, elastic limit and elongation and a small increase in reduction of area. In this case, the extraordinary drop in tensile strength of nearly 12,000 pounds might have been caused by a faulty test bar.

From the above, it is apparent that the first three tests show considerable improvement due to the Cobalt, while

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the last test is negative and may have been caused by the conditions noted above.

NO. 3 COBALT TEST, DRAWN WIRE, AVERAGE PHYSICAL PROPERTIES OF FOUR TESTS TO EACH ITEM. LOW BRASS (COPPER 80, ZINC 20) WITH VARYING PERCENTAGES OF COBALT ADDED.

Bar No.	Gauge.	% Cobalt added.	% Cobalt present by analysis.	Average Tensile Strength pounds per sq. in.	Increased Tensile Strength pounds per sq. in.	% Increased Tensile Strength.
Regular Metal....	.019	None	None	24100		
Regular Metal....	.028	None	None	37092		
No. 1	.019	.10	.13	24394	294	1.21%
No. 2	.028	.10	.12	40612	3520	9.49%
No. 7	.019	.25	.24	27627	3527	14.63%
No. 5	.028	.25	.21	42507	5415	14.59%
No. 9	.019	.50	.40	28509	4409	18.29%
No. 11	.028	.50	.50	44403	7311	19.71%

The above tests were made at the works of one of our largest wire mills, equipped with excellent facilities for determining physical properties and chemical analysis of material. The tests are arranged with reference to the amount of Cobalt added from 0 to .50 per cent. and alternating .019 and .028 gauge. It will be seen that the tensile strength increases with the amount of Cobalt added, although the increased effect (nearly 20 per cent.) with .50 per cent. Cobalt added is not proportionately higher than the increased effect (about 15 per cent.) with .25 per cent. Cobalt added. The increased tensile strength of nearly 15 per cent. for .25 per cent. Cobalt added and nearly 20 per cent. for .50 per cent. Cobalt added is certainly very considerable.

From all the above tests, it is quite apparent that Cobalt has a very beneficial influence, but before drawing any definite conclusions it would be interesting to make many additional tests on many other mixtures of metals and with varying amounts of Cobalt added. As mentioned above, the alloy used in these tests was a 10 per cent. Cobalt 90 per cent. copper alloy and, as will be seen by No. 3 Cobalt tests, where an analysis of each test bar was taken to determine the actual Cobalt content, the oxidizing loss of the Cobalt is almost negligible, amounting to only about 5 per cent.

The writer is greatly indebted to Mr. Clamer and to the several other members whose willing co-operation made this primary paper possible.

SINGLE CELL GOLD PLATING

A BRIEF DESCRIPTION OF THE SALT WATER GOLD DEPOSITING PROCESS.

BY FRANCIS L. MCALOON.*

Although gold plating by the single cell process is plating in its simplest form, there are certain iron clad rules that must be observed in the preparation and manipulation of the solution or it will prove an endless source of trouble. The three fundamentals to bear in mind when using the single cell process (or salt water process) are:

1. The action of the saline solution on the outer cylinder of zinc is the source of energy, hence it is absolutely necessary to have the salt water boiling hot and an excess of undissolved salt in the bottom of the tank so as to insure the water being kept saturated.

2. The rate of deposit is very slow as compared with that from the ordinary cyanide solution so it becomes essential to eliminate, as far as possible, all chemicals that would have a tendency to attack the surface of the work previous or during the deposition of the plate. A large amount of free cyanide or of the hydroxides invariably prove detrimental to the proper working of the process.

3. The chemicals employed possess a very feeble alkaline action, therefore it is of the greatest importance to have the work perfectly clean and free from oxidation before being immersed in the gold bath. When polishing work that is to be subsequently plated or colored in a salt solution, great care must be exercised to keep the crocus or other polishing medium from banking up in the background of the work, which would make it necessary to subject the articles to a prolonged soaking in the cleaning solutions, thereby giving them an excellent chance to become tarnished or stained.

If for any reason the work has been left in the cleaning solutions until it has lost its clear polish, it should be dried and polished over as an attempt to color any work that is even slightly tarnished is sure to result in failure, and, what is even worse, lead the plater to believe his solution is out of order. What is true of the polishing is also true of the dipping or scratch brushing operations. That is, the work must be handled in such a manner that when it is passed to the plater it is practically free from grease or stains. The formulae used for the single cell gold solutions are so varied and have such latitude that it is impossible to choose any single one as being superior to all the others.

Experience and observation seem to agree that the most satisfactory and stable solution is made by using approximately three pennyweights of fine gold (converted into fulminate of gold) per gallon of solution and one ounce of yellow prussiate of potash and one-half ounce of phosphate of soda per pennyweight of gold (or gallon of solution). The yellow prussiate of potash is the essential chemical, the phosphate of soda being added merely to increase the rate of deposit. The addition of carbonate of soda to the solution causes it to yield a deep yellow color; an excess causes a smutty rose colored deposit. The addition of bi-sulphite of soda is indicated when a pale clear yellow is desired.

The action of the carbonate is to darken the color of the gold by making the deposit more flocculent and also to slightly increase the rate of deposit. The action of the bi-sulphite is to neutralize any free cyanide and to accelerate the coagulation and subsequent precipitation of the oxide of iron liberated in the solution by the reaction of the yellow prussiate of potash and the fulminate of gold.

It is generally preferable to remove the oxide of iron by filtration. It is a common practice for platers to add chloride of ammonium to the saline solution that surrounds the gold solution, but as it costs twelve times as much as the salt and their chemical actions are identically the same, its use is a needless expense instead of being of any advantage. It is also false economy to lift the zinc cylinders out each night, as the actual saving in salt and zinc amounts to less than one cent each night, and that small saving is more than offset by the extra cost for labor.

*Electro-Chemist, O. A. Hillman & Co., Taunton, Mass.

DROP-POURING PROCESS OF CASTING*

THE SOLUTION OF A DIFFICULT BRASS FOUNDRY PROBLEM.

BY E. A. BARNES.

One of the most difficult problems that we have had to solve was the successful production of large Navy Bronze castings, averaging 239 pounds apiece, in the form of hemispheres (Fig. 1) and hemispheres with the poles dished in for perhaps one-half the hemispherical depth. These bell-shaped castings are peculiar in cross section in that they have a heavy webbed hub which shades into a very thin wall, which in turn is bounded by a heavy rim or periphery whereby two such hemispheres are screwed together, forming a spherical unit.

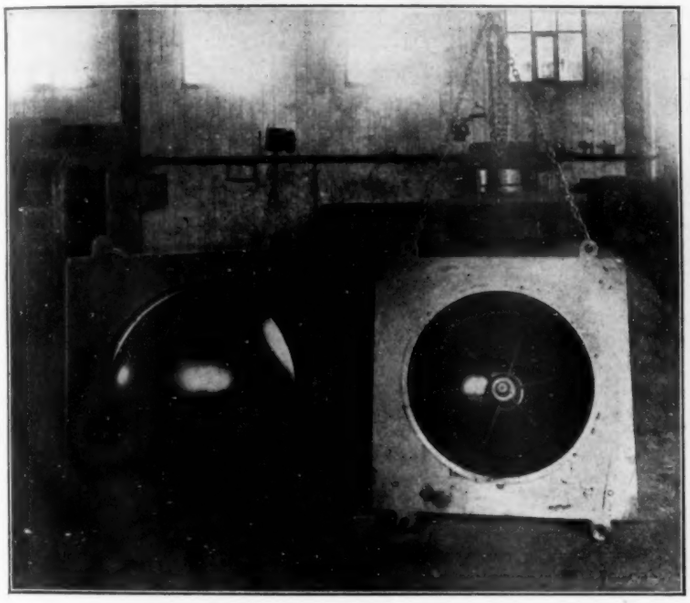


FIG. 1. LARGE NAVY BRONZE CASTINGS.

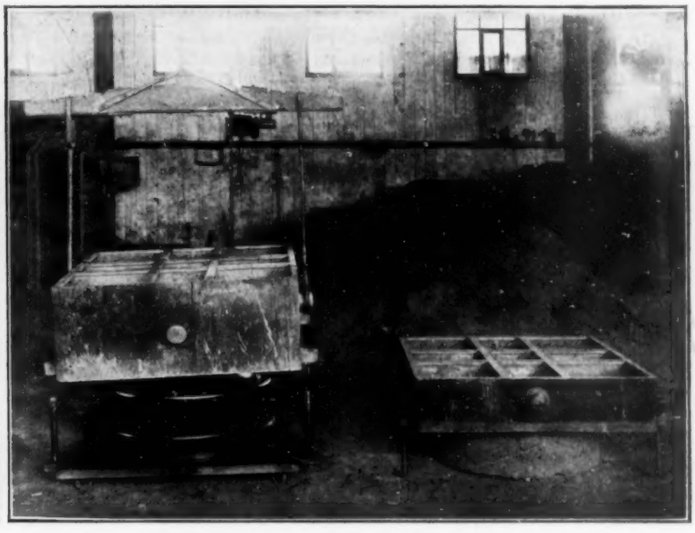


FIG. 2. PATTERNS MOUNTED ON METALLIC FOLLOW-BOARDS.

PATTERNS.

Due to the size, weight and peculiar shape of the castings to be produced, it was decided at the outset to use the match mold process rather than the regular process in which both the inside and outside of the pattern is used for molding or printing purposes. The patterns were therefore mounted on suitable metallic follow-boards and equipped with mathematically correct locating pins which fitted receptacles in the special metal flask bodies (Fig. 2.)

This process (as is well understood) eliminates the cope, both parts of the mold virtually being drags, but of different forms and size, so that when placed together the intervening space is of the exact dimensions of the casting desired.

MOLDS.

The molds are made from specially prepared sand and are faced with graphite and cement, Prussian red or some other modern facing. The molds are baked in a drying oven for about eight hours at a temperature of 650 degrees Fahrenheit to remove the moisture. When the molds are assembled ready for the casting process the runners and risers are stopped with oiled tissue paper to prevent as far as possible the entrance of moisture from the damp air of the foundry.

POURING OF CASTINGS.

In the first attempt at making these castings the regular method of pouring from crucibles was tried, but after making many castings—all of which were defective due to porosity, cold shots and blemishes generally—it was decided that the method of casting was wrong. Many practical foundry men and experts were consulted who suggested other mixtures, the use of phosphorus, phosphor-tin, phosphor-copper, patent fluxes and deoxidizers. All of the suggested plans were tried out but with practically no better results.

It was therefore determined to try the drop-pouring method of casting and since its adoption we have enjoyed a production of 98 per cent. good castings with the molding, baking and other operations remaining the same as originally planned.

Naturally it took quite a little experimentation to work out the details, to determine the best size and number of runners, risers and pouring heads because of the uneven cross-section of the casting. The original theory worked on was that the heavy ring of the bell should be fed with a heavy riser. Experience, however, proved that the shrink head was at times fed from the heavy ring and at other times the heavy ring was fed from the shrink head. Therefore small risers finally were adopted because it was found best that the metal in the runners should chill quickly and seal the metal within the mold when it had once entered. The use of small runners was found to be of further advantage in that the light nicked-in sprues could be quickly removed by a blow from a hammer, while with the heavy runners and gates it was necessary to resort to the use of a power saw to remove sprues from the castings.

The size of the flask in which these bells are cast is approximately a 4½-foot cube; the height of the riser—and overflow tubes used is about 2 feet; the casting pot adds about 1½ feet more to the height, therefore it was

*A paper presented at the Annual Meeting of the American Institute of Metals, September 7-11, 1914, at Chicago, Ill.

found necessary to locate the flask in a pit so that, as a convenience in pouring, the top of the receptacle for the molten metal would come not more than 3½ feet above the floor level (Fig. 3).

The casting pots used are made of cast iron and are not lined with any refractory material, but instead are painted with a suitable stopping-off mixture. The vent at the bottom of the casting pot is fitted with a stopper or valve of machine steel into which an eye bolt is screwed to make its extraction an easy matter.

POURING.

The pouring operation is carried out as follows: The flask is first assembled in the pit and the riser tubes are put in place and cemented with suitable cement to the sand of the mold. The joints between the pouring pot and the riser tubes are also cemented. The stopper is now inserted in the casting pot and the necessary amount of molten metal is poured in (Fig. 4). Both the casting pot and the crucible from which the metal is drawn are kept covered with hard wood blocks to reduce oxidation as much as possible. As soon as the metal in the casting

FIG. 3. FLASK IN A PIT WITH RECEPTACLE FOR POURING 3½ FEET ABOVE FLOOR.

pot has become quiet the boss molder inserts a bar in the eye bolt of the stopper and withdraws the stopper quickly. The entire molten contents of the pot descend the riser pipe rapidly and fill the mold below.

A few minutes after the mold is poured the casting pot and riser pipes are removed and the metal remaining in them is knocked out while it is yet in a red hot condition so it can be returned at once to the crucibles and be mixed with new metal for the next run. No haste, however, is exercised in the removal of the casting from the mold.

ANNEALING.

By the use of microphotography we have ascertained that it is of great advantage to anneal these castings. Any tendency toward porosity in the fillet at the junction between the heavy and light sections seems to disappear with annealing. In proof of this fact two microphotographs are herewith submitted. Photo No. 1 was taken from a section of the rim of one of these bells before the casting had been annealed. Photo No. 2 was taken from a section of the same piece after it had been subjected to an annealing process for one hour at 700 degrees Centigrade.

It has furthermore been found of great advantage to dip these bells in a bath of tin kept at a temperature of 600 degrees Fahrenheit, the casting being allowed to remain in the bath until it is thoroughly tinned and ex-

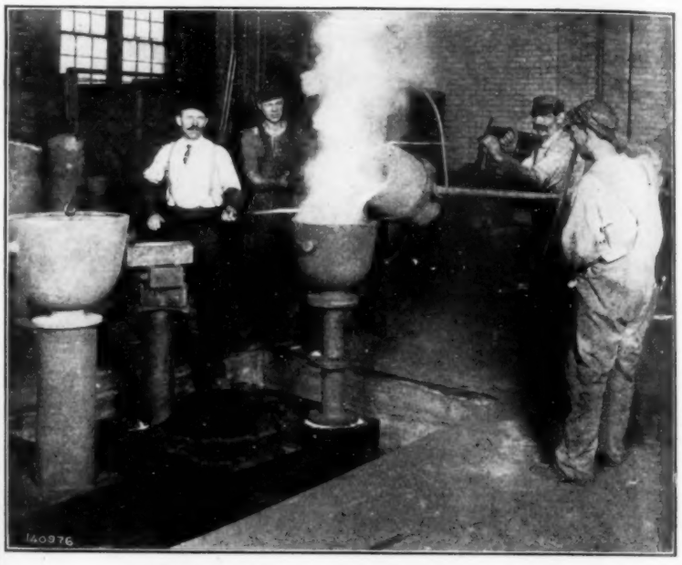


FIG. 4. POURING THE CASTING.

panded. This operation seems to take out all the unnatural shrinks and leaves the bells in much better condition to be machined and handled generally.

In conclusion we wish to emphasize the fact that we have thoroughly tried out the conventional methods of casting in the production of these large bell-shaped pieces, using all the knowledge that has come from a wide experience in brass foundry work, and trying out

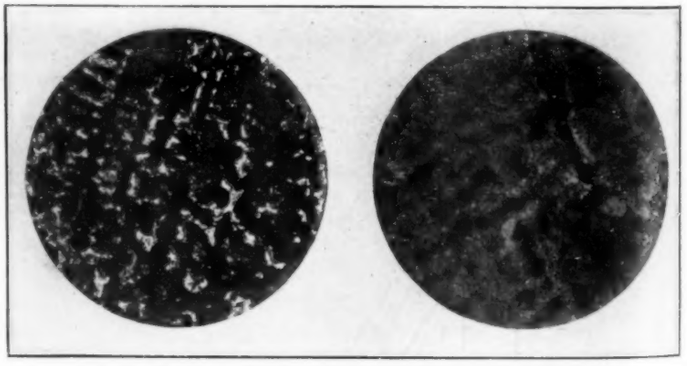


Fig. 1. Unannealed. Fig. 2. Annealed.

EFFECTS OF ANNEALING SHOWN IN MICRO-PHOTOGRAPHS.

many different kinds of mixtures, but have found no combination of method and mixture that gives anything like the satisfactory results that we now obtain from the regular Navy Bronze mixture and the drop process of casting, followed by the annealing or tinning as described in this paper. Visiting experts after having looked carefully over the situation have agreed with us that this plan is unquestionably the best solution of the problem. It has been an extremely interesting problem to solve and we offer the results of our experience in the hope that it may be of help to fellow casters.

THE PHYSICAL PROPERTIES OF COPPER AS AFFECTED BY SMALL QUANTITIES OF PHOSPHORUS MANGANESE AND TIN *

By C. P. Karr.

Some recent investigations of Mr. E. Muenker are of interest. The copper used was a very pure product made by the Baltimore Electric Rolling Company. By analysis its composition was:

Cu 99.823, Sb + Sn = 0.001; As = 0.003; Ni + Co = 0.003; Zn = 0.012; Fe = 0.005; Oxygen = 0.153; Mn + Bi = traces. The impurities it contained could have had but an inappreciable effect, as only a small percentage of the whole alloy was used to introduce the desired element. The fusions were made in a natural draft, coke fired, crucible furnace. The pure copper was first melted under a covering of charcoal, glass and borax. Then a measured quantity of the contaminating elements were added as required, stirred with a graphite rod, and poured into bars 200 × 120 × 25 mm. (7.874 × 4.734 × 0.984 in.) Part of the charge was poured into sand molds and part into iron molds. After being cleaned, all defective bars were removed. The sound bars were heated to redness and then rolled with ten passes to reduce the thickness to 7 or 8 mm., plunged into water to remove the scale, rolled in the cold longitudinally with 15 passes to obtain a still further reduction in gauge to 3 mm. Rods for rupture tests were cut from these bars in the direction of the final rolling. The rods were brought to the required shape by means of a power press, and edges dressed smooth by a file to the requisite dimensions. The test bars were arranged in three groups The first set was unheated, the second set was heated to 500 degs., protected from the air and quenched quickly in water, the third set was heated in the same way and cooled slowly. The bars of the last two groups were enclosed in an iron box, packed with a mixture of brush wood, charcoal and shavings of the metal, and heated in a muffle furnace. The temperatures were taken with a Le Chatelier thermo-couple.

The first test was made with the pure copper. There were seven phosphorus alloys, containing from 0.014 to 1.062% phosphorus. Ten alloys containing from 0.04% Mn to 1.49%, and from 0.012 to 0.026 % phosphorus, and ten alloys containing from 0.13 to 1.46% tin and 0.011 to 0.019% phosphorus.

The rupture tests were made on a machine with two revolutions operated by hand, and with one of fifty revolutions operated by a motor. The results were as follows. The average of 7 tests of the phosphorus alloys and of 10 manganese alloys and of 10 tin alloys being given.

	Heated to 500° C.					
	Unheated.		Plunged into water.		Cooled slowly.	
Material.	Limit of rupture kg. per sq. mm.	Elongation at rupture %	Hardness Brinell. test.	Limit of rupture kg. per sq. mm.	Elongation at rupture %	Hardness Brinell test	Limit of rupture kg. per sq. mm.	Elongation at rupture %	Hardness Brinell. test.
Pure copper	36.78	4.24	94	23.96	46.07	74	22.83	46.64	63
Phosphorus alloys	42.71	3.24	123	26.95	41.61	79	25.05	42.79	72
Manganese alloys	39.92	4.02	102	25.44	43.25	81	24.71	43.98	79
Tin alloys	44.29	2.93	121	27.98	42.22	89	26.64	42.64	86

The averages are based on the mean of five separate results which show the maximum variation of 1 kg. per square millimeter for rupture and of 1.3 per cent. for the elongation at moment of rupture. This elongation is figured in per cent. of the length taken between pulling points.

For alloys of phosphorus the resistance to rupture depends upon the per cent. of P, but is inversely for the elongation. This action of P is appreciable for excessive small quantities. Upon unannealed alloys the influence of Mn upon the elongation is not appreciable. The influence of tin is favorable since the resistance to rupturue is augmented where the elongation remains appreciably constant.

The hardness tests show their dependence upon the per cent. of the elements contained, and that the hardness is affected more in the heated state than in the unheated.

ELECTRICAL CONDUCTIVITY.

The measurements were made upon a wire drawn to 2 mm. diameter. The Thompson bridge was used, length of wire was 100 mm. and the temperature 22 degs. C. The tests were conducted upon the products in four different conditions: (1) unannealed; (2) reheated to 500 degs. C. and annealed; (3) reheated to 700 degs. C. and cooled slowly; (4) reheated to 700 degs. C. and annealed.

The values for the conductivity are indicated in the following table under the expression $10 - {}^{4}W$ (the resistance W of a wire 1 meter long and 1 millimeter square in sectional area, expressed in ohms $= 10^{4}W$. Inversely 10^{4W} = the specific conductivity. Reheating augments the conductivity of pure Cu and where the Cu is alloyed with Mn and Sn, but diminishes the same in the phosphorus alloy.

	Unheated.		Heated to 500° and quenched.	Heated to 700° and cooled slowly.	Heated to 700° and quenched.
	10^{4} W.	10^{4} W.	10^{4} W.	10^{4} W.	10^{4} W.
Pure Cu	57.0	0.0175	57.2	58.5	58.1
Alloys of P. (P. = 0.11 P.)	26.8	0.0547	30.6	30.6	30.5
Alloys of Mn. (Mn. = 0.04)	54.1	0.0185	54.6	55.5	55.1
Alloys of Mn. (Mn. = 0.19)	26.3	0.0436	26.7	27.1	26.6
Alloys of Sn. (Sn. = 0.13)	36.9	0.028	37.7	37.8	37.5

The result for P is the combined mean of 6 tests, for the first set of Mn the mean of 3 tests, for the second set of Mn the mean of 7 tests, for the tin the mean of 10 tests.

SPECIFIC GRAVITY.

The determinations were made with a picnometer upon four samples of each alloy (unheated). The weight was taken and referred to a vacuum state, the temperature of the water = +4° C.

*Adapted from Revue De Metallurgie.

TABLE OF SPECIFIC GRAVITIES.

Sp. gr.		No.
1	Pure copper	9.008
3	Alloys with P. (0.040% P.)	8.945
5	" " " (0.173% P.)	8.938
6	" " " (0.399% P.)	8.903
8	" " " (1.962% P.)	8.758
9	Alloys with Mn. (0.04% Mn.)	8.905
12	" " " (0.19% Mn.)	8.903
16	" " " (0.98% Mn.)	8.860
18	" " " (1.49% Mn.)	8.820
19	Alloys with tin (0.13% Sn.)	8.943
22	" " " (0.40% Sn.)	8.930
25	" " " (0.88% Sn.)	8.917
28	" " " (1.46% Sn.)	8.911

(Note.—At the recent convention of the American Society for Testing Materials held at Atlantic City in June, it was agreed to accept the figure of 8.99 as the typical specific gravity of pure copper.)

METALLOGRAPHIC RESEARCH.

The pure copper was not reheated but worked in the cold and presented a fibrous aspect; by reheating for only one minute a crystalline structure appeared. The alloy of 1.06% P was not reheated, it presented lines alternately clear and dark colored. Heating did not modify this aspect. The dark colored parts were formed by the eutectic Cu-P.

In conclusion, the addition of P. Mn or Sn to Cu augments its resistance to rupture, increases its hardness, diminishes its elongation, electrical conductivity and specific gravity. Unheated copper is modified by P, Sn and Mn in this order of their occurrence, but for reheated copper Sn and Mn act more strongly than P.

For all alloys reheating diminishes the resistance to rupture and decreases the hardness, increases the elongation and powerfully affects the conductivity and the specific gravity.

EFFECT OF THE WAR ON CHEMISTRY IN ENGLAND

THE CONDITIONS HERE DESCRIBED AFFECT IN THE SAME MANNER LABORATORIES IN THE UNITED STATES.

BY AN ENGLISH CHEMIST.

One of the businesses badly hit by the war is that of analytical chemistry. It will surprise many of our readers to learn that the whole of the glass and porcelain apparatus used in chemistry is made in Germany and Austria. To the best of our knowledge there is not a single firm in England who make this apparatus, and the quantities used run into many thousands of pounds per annum.

Bohemian glass, Royal Berlin porcelain, Dresden porcelain and Jena glass are names known to chemists all over the world, such is the reputation they have obtained. It must not be thought that the apparatus is cheap, and that this is the cause of foreigners having the market; it is not by any means; the sole reason they have obtained the trade is that they have studied the scientific manufacture of the articles and with the aid of well-equipped laboratories have obtained the best results. The price of these goods went up 50 per cent. immediately war was declared, and as the stocks in this country are being rapidly depleted, further advances are to be looked for.

Some apparatus is already unobtainable. Filter papers are another line of which the price has advanced 50 per cent., and the German stock in England is running out. These are also largely obtained from Sweden, but the prices have already gone up 50 per cent., no doubt owing to the impossibility of obtaining the necessary raw material. Some filter papers are made in England, but, strange to say, our climate is not cold enough in the winter to make the high-class chemical filter papers and, consequently, they will always have to be obtained from colder countries. Intense cold for weeks at a time is necessary to obtain good quality filter papers. The pure chemicals used in analysis are largely obtained from Germany, but the supply, of course, being cut off and stocks giving out, prices are advancing enormously from 50 per cent. to 600 per cent. There seems to us to be no reason why chemical glass and porcelain ware, as well as the highest quality of pure chemicals should not be made in England as well as in Germany and Austria. Our chemists are the equal, scientifically, of German chemists, but the manufacture of this apparatus needs capital. If the advance of science is to continue—and it affects the brass and copper trade equally with other trades—we must be independent of Germany for these goods. Unfortunately, they cannot be made quickly, even if the works and material are on the spot. We understand that it takes two years from the time the clay, of which the Royal Berlin porcelain is made, is mined until it becomes the finished article known to laboratories. Not only for their own benefit, but for the benefit of the trades of the nation, chemists should economize in glass and porcelain apparatus as much as possible. If the war lasts six months longer, as, unfortunately, there is every possibility of it doing, some laboratories will probably have to close down for lack of apparatus, and this at a time when the services of every chemist in the country will be needed to capture German trade.

The brass clamps, crucible tongs, watch glass clips, and such like metal apparatus used in laboratories are nearly all made in Germany. English manufacturers expect to cover the expense of putting down new plant for this work on their first order, instead of dividing it up among several orders, and they will not take up the manufacture. Some of the German brass apparatus is very inferior in quality, and analysts would prefer a better quality article at an increased price.

It is useless trying to capture German trade without making the fullest use of modern science. German works spend thousands of pounds every year purely on research work, and do not hesitate to call in outside specialists if their own chemists cannot find out what they want. This is why the output of various comparatively rare, but now important, metals is in their hands. We understand that a German firm controls the world's supply of tantalum. The non-ferrous metals used in the manufacture of metallic filament lamps are now to a large extent made in England, and there is no reason why all the rare non-ferrous metals hitherto made in Germany, should not be made in this country. The business is important, and it is rapidly extending.

The upkeep of chemical laboratories has increased enormously, and there will be a big demand for competent chemists in works—in fact, it is difficult to get reliable assistants even now, except at much higher salaries than some manufacturers have hitherto thought were adequate remuneration for chemists some years ago.

MODERN PLATING EQUIPMENT AND SUPPLIES

A Description of Their Development and the Uses to Which They Are Devoted.

By E. S. Thompson.

(Concluded from April.)

I want to emphasize the fact that a voltmeter and ammeter are important instruments to the plater. When these two instruments are used, although the plater may have no previous knowledge of the weight of a certain metal deposited from a standard solution under a certain voltage and a certain number of amperes in a given length of time, if he is wide-awake and watchful he will not be long in ascertaining what is the right current density to use in his own solution to get the most satisfactory results, while if he has no instruments to tell him what his dynamo and solution are doing he will have some work unsatisfactory in spite of all he can do.

Let me illustrate: On Saturday he replenishes his nickel solution and brings it up to the standard at which he wishes to work it for his particular class of work. On Monday, his helper, who is very often careless and not at all familiar with all phases of the science of plating, accidentally drops a rod or some other metal object against one of the conductors and the other end rests upon an iron pipe. This rod is in an out of the way corner, not easily seen, and the plater, *supposing* everything is all right, goes on about his duties. In half an hour the helper goes to the tank and finds that the work is plated but does not look right. He *supposes* it will be all right and *passes it* on out to the buffer, who finds that there is not sufficient metal to color up. It is then that the foreman's attention is called to it. He asks his helper what point on the rheostat he set the current. He finds that that part of it was all right. He examines his connections and finds them O.K. He raises his anodes and they are clean. He takes a wire and tests the strength of his current—that shows up strong. He is puzzled because he cannot find what was wrong and decides that his solution has not conductivity enough and starts in to "doping." Still the next load is not properly plated and there are two batches of work to be refinished and a spoiled solution besides a great deal of time lost. Of course an old experienced plater would know where to look for the trouble, but not all of them have had experience with hidden grounds and short circuits and, besides, the electrical proposition is a puzzle to many platers, even at this time.

Where voltmeters and ammeters are used, the tale would have been told at once. The voltmeter, of course, would have shown the correct voltage and by changing the points of contact on the switchboard the plater could have located the waste of current and remedied the trouble at once or as soon as the load was in the helper could have known whether the right number of amperes were passing through that solution and could have called the foreman's attention to it at once if he could not find the cause of the trouble.

It must be considered that the plater in charge of a shop working several men has a great many things to watch, especially if the work is of a class of which thousands of pieces are finished each day, and he cannot be everywhere at once. He must depend on others for the production of the work. It may happen that while he is engaged in locating the cause of failure in the plating room he will be called away in a hurry and while he is gone someone of his help, not knowing what was intended, will undo all that he has accomplished. Train them? Discharge them? How are you going to train men with whom you cannot converse and if you discharge them you would be compelled to hire another who might be worse.

Plating is a science and requires as much study and thought as any of the professions and the time is already here when the plater must deliver the goods or make way for one who can. All platers do not work exactly alike, some preferring one process, some another, but with the scientific investigations now being conducted it will not be long until solutions will be standardized and the trained plater will find his work much more pleasant and he will be held in higher esteem than ever before. Manufacturers are beginning to realize the importance of the plating room and are seeking men of high efficiency to take charge of this department. It is the finish of an article that sells it especially in the decorative line. It makes no difference how much time and expense have been put on an article to make it durable, if it is to be used in a home or in a public place it must be pleasing to the eye if it finds a sale. The writer has visited many shops in this country and he has found conditions in some of them very bad, while some manufacturers gave the plating room a great deal of attention and they were repaid by seeing work of durability and beauty of finish come from it.

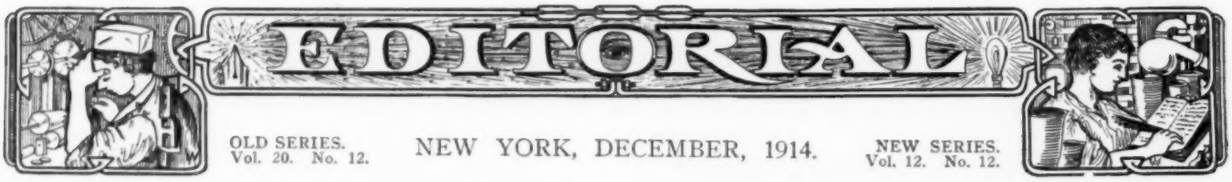
The old methods of having work highly finished on the polishing wheels so that a high finish could be had by buffing after plating have passed out of practice. It used to be the idea that a brilliant finish could not be obtained without the work being put over four sets of wheels. Now it can be done on two, and work that is comparatively smooth to start with can be finished up brilliantly with only one operation on the wheels, previous to plating. The modern dynamos previously mentioned and the modern solutions have made this possible, saving large sums of money to manufacturers in the matter of help, equipment and supplies.

CRUCIBLE CONDITIONS.

Considerable embarrassment is now being experienced by various crucible manufacturers throughout the country, owing to the difficulty in obtaining necessary clay which is used in the manufacture of crucibles and other fire resisting products.

This clay is obtained from Germany, and, of course, owing to the war it is impossible to get any more of it at the present time, and some dealers think that there will be no shipments received in this country within a year at least and probably not then if the war continues.

Mr. Jonathan Bartley, president of the Bay State Crucible Company, Taunton, Mass., in a recent interview stated that this was one of the reasons why the Taunton Crucible Company of that town had been forced to shut down, while he states that his own firm will be able to continue under usual conditions for about six months. Mr. Bartley says that the situation is really serious because the crucible manufacturing business is one of the most important industries of the country, owing to the fact that every metal casting produced must be made in a graphite crucible. While experiments have been made with clays from other sections of the world, up to the present time no good substitute has been found for the German clay, and this, together with the possible shutting off of the supply of graphite which comes from Ceylon, makes the outlook for crucible manufacture rather poor.



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CONTENTS

FAILURE OF ENGINEERING BRASSES

A serious arraignment of "manganese bronze" and other brasses as reliable engineering materials is contained in the paper read at a meeting November 25, 1914, of the Society of Municipal Engineers of the City of New York, by Alfred D. Flinn, deputy chief engineer of the New York Board of Water Supply.

This paper, which is published nearly in full in this issue of THE METAL INDUSTRY, describes the experience of the Water Supply engineers in attempting to use these metals as a permanent part of the Catskill Aqueduct Water Supply System. There are also given the details of the methods pursued by the engineers for the testing of these materials in the laboratory. The failures described by Mr. Flinn naturally have caused the engineering profession represented by the Water Supply Board to look with suspicion upon the claims made by manufacturers as to the enduring qualities of "manganese bronze" and other brasses. The engineering mind now questions whether these materials can with safety be substituted for steel with permanent results, even granting the drawback of corrosion of steel and iron.

The questions asked by Mr. Flinn at the close of his paper deserve the careful consideration of the manufacturers of Tobin bronzes and other high tensile brasses, and in order to remove the stigma now resting on the fair name of these important materials they should lose no time in coming forward and explaining away the apparent defectiveness of the complex alloys.

It was expected and hoped by Mr. Flinn and his fellow engineers who had gone to great trouble to prepare their reports that some of the producers of these alloys would attend the meeting and speak in defense of their product. There was only one manufacturer represented at the meeting and all that these representatives (there were two of them) had to say was, "that they had so far had no proof that any of their material had failed," and further, "that manganese bronze in order to be satisfactory should be made from new metals and probably, due to low prices paid for the water system bronze, the metal that failed had been made from scrap." It was also stated, "that the engineers seemed to think that producers should tell their manufacturing secrets, and this the speaker was very sure would not be done." Judging from the tone of the remarks made by the engineers who spoke on the matter, we should say that all the engineers want the manufacturers to do is to tell them why the alloys fail or of their susceptibility to failure, and they are perfectly willing to leave the "secrets" to the producer.

The fact stated in the paper by Mr. Flinn, that no

trouble has been had with the *castings*, but *all* of the failures, so far, has been with cold and hot worked material goes a long way to prove that *all* of the manufacturers have the "secret" of producing manganese bronze castings that will not fail, but none have the secret for hot and cold working all of the brasses and bronzes. Inasmuch then as the producer present at the meeting stated that his company had not furnished any of the material that failed, it looks as though there was only one manufacturer that could guarantee to furnish manganese bronze that will not fail when made in accordance with his formula.

The whole "secret" of the matter, it seems to us, is that it is not yet fully understood how to work manganese bronze and other alloyed rod in the hot and cold. There are undoubtedly internal strains set up in the working which are not relieved and consequently the metal fails. The matter is now receiving serious attention from the manufacturers and we hope some of them will come forward and give their views and advice. The columns of THE METAL INDUSTRY are open and we should be very glad to do all in our power to help to clear the cloud now in the eyes of the engineers and to vindicate manganese bronze and certain other bronzes and brasses.

BRASS IN ENGINEERING CONSTRUCTION

To the Editor of The Metal Industry:

Referring to the meeting of the municipal engineers last Wednesday, and to the paper read by Mr. Flinn on "Brass in Engineering Construction," you will recall that during the evening there were two remarks made by members of this society that reflected on the product of the Cramp company.

The first was by Mr. Flinn in the course of reading his paper in which he stated that bronze furnished by all manufacturers had been involved in the trouble experienced, and upon my inquiry of him in regard to the particular location in the aqueduct work of the bronze manufactured by the Cramp company that had failed, he stated that I could see a sample in the testing laboratory but did not wish to go into detail at that time. The second remark was made by Mr. Williams in which he stated that he had had experience with all makes of rolled bronze, and had found defects in all including the Cramp product.

After the meeting in conference with Mr. Flinn and Mr. Williams I found that both referred to a sample piece of bronze 1⅝ inches diameter by 6 inches long, furnished by us from stock that had been in our bins for over ten years, and that neither Mr. Flinn nor Mr. Williams knew of any of our material used in the construction of the aqueduct that had failed. In other words, no instance of our bronze having failed in the work of the Board of Water Supply has yet come to light, and if you will pardon my seeming positiveness I feel warranted in stating to you now that none will come to light. In regard to the sample piece forwarded from our old stock I understand that the cracks in this piece were not found therein by Mr. Ernst Johnson, engineer inspector of the Board of Water Supply, but were artificially made by him with the use of mercury.

I regret very much that at the meeting I was not in possession of the facts as given above, as otherwise our bronze would have received a much stronger defense than we were able to put up under the circumstances. However, it is our purpose to cooperate with the engineers of the Board of Water Supply and the Bureau of Standards in thoroughly investigating all cases of the failure of bronze or brass that affect the reputation of manganese bronze, and make certain that the municipal engineers of the City of New York are finally in possession of the facts. We are certain that by so doing our bronze will receive a greater favorable advertisement than we have ever put out.

I noticed a disposition at the meeting to switch off from the discussion of failures in bronze to a discussion of the real strength of bronze. This latter I consider an entirely separate matter. We are, however, co-operating in the investigation of this question by furnishing to the Bureau of Standards at the request of the engineers of the Board of Water Supply samples of the Parsons' bronzes that we manufacture and have manufactured for a long time of quality very much in excess of that of the regular Parsons' manganese bronze, which latter metal has been so widely imitated, although unsuccessfully. None of the imitations at present in the market in any way approach in physical properties the high quality bronzes to which I refer.

W. P. Smith, Superintendent of Sales,
The William Cramp & Sons Ship & Engine Building Co.
Philadelphia, Pa., December 1, 1914.

To the Editor of The Metal Industry:

Referring to the question of failures of rolled bronze rods in engineering construction, as taken up by Mr. Alfred D. Flinn before the Society of Municipal Engineers of the City of New York recently, I desire to point out at this time that a great deal of the confusion existing in the minds of the engineers of the city of New York would be cleared away if they would recognize that the proper manufacture of the rolled rods begins with the mixing of the metal for the ingots out of which the billets for rolling are made. Until they are willing to acknowledge this they will not arrive at the real cause of their trouble.

The responsibility for defects in rolled rods can be placed upon four causes, viz.:

1. The use of inferior metals in manufacturing the ingots.
2. Improper processes of manufacture of the ingots.
3. Defective workmanship in the casting of billets.
4. Improper rolling or cold drawing by the manufacturer of the rods.

I have been actively engaged in the manufacture of ingots and billets for rolling Parsons' manganese bronze rods for over ten years, and in all that time I have never known of a defective rod having been made in this metal. In view of the success that our company has had, I do not feel that any editorial comment you make will be complete or accurate that involves us in any of the trouble. We have complete knowledge of the making of the ingots and casting of the billets and the rolling of the rods, and I do not think that our work should be coupled with that of the other manufacturers of bronze.

N. H. Schwenk, Metallurgist.
The William Cramp & Sons Ship & Engine Building Co.
Philadelphia, Pa., December 5, 1914.

NEW BOOKS

GALVANIZING AND TINNING.—By W. T. Flanders. Size 6 x 9 inches. 300 pages. About 100 illustrations. Substantially bound in cloth. Published by the David Williams Company. Price $2.50. For sale by THE METAL INDUSTRY.

This work is the long looked for revised edition of Flanders' work on Galvanizing and Tinning and has become the recognized authority on its subject.

It gives practical instructions on hot galvanizing, electro galvanizing, sherardizing and tinning, describing the location, erection and equipment of plants and modern methods of cleaning, preparing and coating with zinc and tin all classes of work. The various processes have been treated by experts and the result is the last word on the subjects covered.

Shop Problems

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE OF THE METAL INDUSTRY. ADDRESS THE METAL INDUSTRY.

ALLOYING

Q.—Kindly advise me what shot aluminum, as used by the steel works, is and the analysis of same. Also kindly advise me the analysis of pattern alloy aluminum.

A.—Shot aluminum is a special alloy of aluminum, 97 to 98, and silicon and iron, 2 to 3 parts.

A formula for a pattern alloy aluminum consists of the following:

Aluminum	90 parts
Copper	8 parts
Tin	2 parts

J. L. J. Problem 2,067.

BABBITTING

Q.—We are supplying a low-grade babbitt metal containing 6 per cent. of tin, 14 of antimony and 80 of lead. This metal is used in lining the interior of small cylinder barrels of cast iron, and the casting is about ⅞-inch thick and 12 inches long. The metal is poured at a high temperature, using a wood mandril for the center. This gives about 1½ inches of babbitt near the ends, with about 2¼ inches in the middle, with a total weight of about 15 pounds per casting. The trouble has been after pouring and cooling, the metal appears to fit closely, but upon using a shaft there appears a perceptible looseness which increases with time. Parties have used the castings both heated and cold, but with no better results as to the contraction. If you can, advise any low-cost addition to this metal that would not have the contraction quality of this mix.

A.—A lining of babbitt of 1½ to 2¼ inches is too thick and is almost certain to give trouble if the pressure is heavy. Wooden mandrils should never be used, especially if babbitt is poured at a high temperature. By using an iron mandril, heated, and pouring at a medium heat, the babbitt would feed down better into the shell and give a more solid lining.

Some makers of low grade babbitt have added 1/10 per cent. of bismut to reduce shrinkage, but results obtained have not warranted its use. The babbitt lining should be well anchored at the ends with anchor holes and its thickness reduced, if possible.—J. L. J. Problem 2,068.

CASTING

Q.—I am casting a bronze bearing with a ½-inch hole with grooves running through them like a thread and which are to be filled with grease. I am having trouble in getting all the sand and grit form these grooves which is left in by the cores. I would like to know if a graphite core wash would help in this case, and what acid would be best to clean out the sand and not eat off metal.

A.—You are probably making your bearings from phosphor bronze and pouring it too hot. The phosphor bronze should be cooled by holding an ingot in the pot until it stops melting freely. Cores may be washed with a good grade of silver lead, but regular steel facings may be used if necessary. Hydrofluoric acid is the best acid for cleaning out sand from the grooves.—J. L. J. Problem 2,069.

COLORING

Q.—Can you give us the formula that is used in coloring copper that is made up of iron nitrate?

A.—The following formula is frequently used in coloring copper with nitrate of iron:

Hot water (180 degrees Fahr.)	1 gallon
Hyposulphite of soda	2 to 4 ounces
Nitrate of iron	8 ounces

These proportions may be varied somewhat according to conditions. Acetate of lead is frequently used for the same purpose. The formula is as follows:

Hot water	1 gallon
Hyposulphite of soda	4 to 8 ounces
Acetate of lead	2 to 4 ounces

C. H. P. Problem, 2,070.

DEPOSITING

Q.—We have a silver solution which will plate all right on brass, but will not plate on graphite fountain pen barrels and caps. When plated on fountain pen barrels it sometimes plates snow white, sometimes gray and other times a reddish brown color. We have had several experts look at the solution and try it out, but they have been unable to fix it. Kindly advise what is the trouble.

A.—The fountain pen submitted indicates that the solution used was too low in metal content and too high in free cyanide. A solution that will deposit good on brass is hardly suitable for deposit work. For such work there should be around 4 ounces of metal per gallon and about 1 ounce of free cyanide less than the metal content.

The deposit on the pen is very brittle, showing coarse crystalline deposit. The roughness is caused by the forcing the current to obtain a covering of metal. Gases generally start at the bottom of the cathode and work up, and this can be readily seen on the pen, gassing being caused by excess of free cyanide and a high pressure.

Would advise the use of copper instead of graphite, as it covers more readily. One volt pressure is sufficient. The solution given does not give good results on brass unless great care is used in cleaning and striking the work.—H. Problem 2,071.

GLUING

Q.—We wish to know of a good glue for gluing cloth to tin containers. We are using a stiff flour paste or mucilage over a first coat of shellac, but wish to find an easier method whereby we can stick the cloth directly on the can without first coating with shellac. It should be a composition that does not penetrate the cloth easily.

A.—We would advise that instead of using glue for your purpose that you try a solution of commercial sodium silicitate. You will find that the cloth can be applied directly to the tin by the use of this material without previously coating with shellac. A thin coating is all that is required and it can be applied in the regular manner.—C. H. P. Problem 2,072.

MELTING

Q.—Kindly let us know how German silver can be melted into plate or bar of 18 per cent. We have tried it several times but cannot make a success of it.

In the first place, we have a gas furnace and have trouble in getting the heat and when we do get the German silver melted into plates or bars we have trouble in rolling it, as it cracks and breaks as soon as put in the roller. We put very little draught on it in rolling.

A.—The process of making German silver is quite a difficult one and in order to be successful in making castings without undue loss considerable experience is necessary. We would advise that you employ some man who has had experience in the casting of this metal, as we do not believe that a man who has never made the mixture will be able to get good results until he has gone through quite some ex-

perience at the firm's expense. Judging from what you say we should imagine that the metal had been heated too long in the furnace in order to get it melted and oxide of nickel formed in excessive quantities, thus rendering the resultant metal hard and brittle. German silver must be melted at a high temperature and not left in the furnace any longer than is absolutely necessary after it has become melted and must be protected from the gases of combustion by a layer of charcoal and broken glass, which acts as a preventative to oxidation. We should think that if you only have a small quantity of this material to make that it would pay you better to buy it, unless, as stated above, you have an expert caster in your service.—K. Problem 2,073.

MIXING

Q.—Can you give us the formulas for several mixtures of brass for valves? Some with a large percentage of scrap brass to be used on standard grade competition valves for natural gas and some with new metals for high pressure steam.

A.—No. 1.

Red brass scrap	75 pounds
Yellow scrap brass	14 "
Copper	8 "
Zinc	2 "
Lead	1 "

No. 2.

Red scrap brass	73 pounds
Yellow scrap brass	18 "
Copper	4 "
Zinc	3 "
Lead	2 "

For mixtures with new metals use the following:

No. 1.

Copper	84 pounds
Tin	10 "
Zinc	4 "
Lead	2 "

No. 2.

Copper	87 pounds
Tin	7 "
Zinc	4 "
Lead	2 "

No. 3.

Copper	88 pounds
Tin	5 "
Zinc	3½ "
Lead	3½ "

In the mixtures where large amounts of scrap brass are specified, care should be taken in selecting the scrap, as a great many foreign substances are incorporated with them. Aluminum is one of the worst, as it will make your castings porous and will not stand a pressure.—P. W. B. Problem 2,074.

PHOSPHORIZING

Q.—We should be glad to have your opinion on the best way to mix phosphor sticks with copper. We have put the sticks in crucibles and covered them with copper borings, but do not get satisfactory results in the percentage of phosphor. If you can enlighten us on this subject we shall appreciate it.

A.—A method of making phosphor copper that is said to be superior to the one involving the use of copper borings is to use copper shells, covering the stick phosphorous with them. The shells are supposed to retain the phosphorous vapor and to enable the phosphor copper to form at a lower temperature and with less loss.—J. L. J. Problem 2,075.

PLATING

Q.—We would be pleased to have you give us some information in regard to plating zinc or copper with lead.

A.—The electro depositing of lead is not a difficult operation. The same methods of cleaning should be followed. The most difficult part is to obtain very thick deposits. We give you two solutions that give very satisfactory results.

The first solution can be used for lead coating copper and the second for coating zinc, but the zinc should be thinly coated with copper before plating with lead.

No. 1	Water	1 gallon
	Litharge	2 ounces
	Caustic potash	16 ounces

Dissolve the caustic potash in the water, then add the litharge. The solution should be heated until the solution is clear. If small portions of the litharge remains undissolved, add from ¼ to ½ ounce more caustic potash per gallon of solution, or until clear. Sheet lead anodes should be used and the solution should also be cold.

No. 2	Water	1 gallon
	Lead perchlorate	1 pound
	Perchloric acid	½ pound
	White gelatin	½ pennyweight

The lead perchlorate should be dissolved in the water (preferably warm) and then the acid added slowly until the solution becomes clear. Probably less than the prescribed amount of acid will answer the purpose. Try the solution, and if a good deposit can be obtained with 6 ounces of the acid then do not add the balance. Anodes of sheet lead may be used, as in the previous solution.—C. H. P. Problem 2,076.

SOLDERING

Q.—We should be obliged to you if you could tell us of a material that could be applied as a paste or varnish to prevent soft solder running on brass and copper surfaces in directions where is is not required.

A.—Use a solution of sodium silicate, which is commonly termed water glass. The material may be thinned down with water. A little of the material applied to the copper or brass surface will prevent the soft solder running over such protected surfaces.—C. H. P. Problem 2,077.

SMELTING

Q.—Will you please explain what blister copper is as against copper matte and are copper matte and copper concentrates one and the same?

A.—Copper matte is practically the first product that is produced by the copper smelter. The matte or regulus, as it is usually known, is really the concentration of the mineral content of the ore, together with sulphur, which helps to separate the minerals from the worthless rock. Copper matte, therefore, may contain practically all of the mineral content of the original ore. The matte is then put into the reducing furnace and blister copper is the first result, which would contain from 97 to 99 of copper and from .25 to .75 per cent. sulphur. The blister copper is then the basis of the refined copper after it has been put through the refining furnace and the sulphur and impurities are there separated.

The term copper concentrates, while it might seem to apply to copper matte, really designates the material resulting from a mechanical separation of mineral matter and gangue rock, whereas copper matte, strictly speaking, is also a concentration, but one that has been produced by actual smelting. A more simple definition of blister copper is that it is high-grade crude copper in which nearly all the oxidizable materials are removed by slagging and volatilization.—K. Problem 2,078.

STRIPPING

Q.—Will you kindly inform me as to the process or solution by which brass is stripped from an article which has been brazed? For example, I have brazed some motorcycle handlebars, seat posts and other such articles from which I would like to strip the brass without having to file same, if that can be done.

A.—You will be unable to remove the brazing solder chemically without weakening your joints. Owing to the unevenness of the surface of the brazing it would take longer to remove the solder in some places than in others, consequently the solder that was very thin would be removed quickly and then the solder in the joints would be attacked. You might try a solution of concentrated nitric acid for the purpose. This will remove the brass very rapidly without affecting the steel.—C. H. P. Problem 2,079.

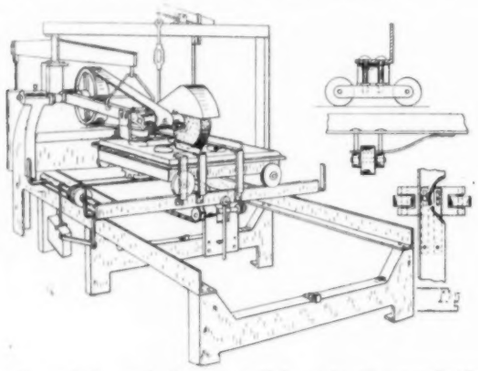
PATENTS

REVIEW OF CURRENT PATENTS OF INTEREST TO THE READERS OF THE METAL INDUSTRY.

1,114,809. October 27, 1914. **Grinding or Polishing Machine.** W. V. Robinson, Detroit, Mich.

This invention relates to grinding or polishing machines.

The invention resides in the novel means for effecting a proper, relative movement between the grinder or polisher, as shown in cut, and the article to be operated on; in the means for effecting an automatic, relative adjustment between

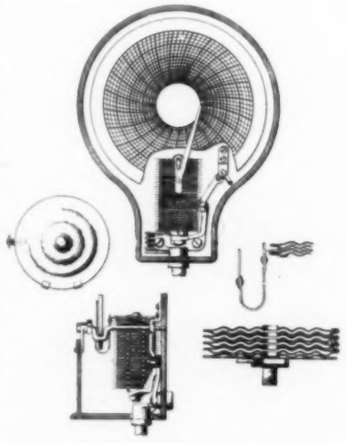


the work and the grinder or polisher; in the producing of a structure in which the grinder or polisher is driven at a uniform speed and also the relative movement between the grinder or polisher and the work is uniform; in the relation and construction of the traveling carriage and frame; in a device for retaining the work in proper relation to the grinder in a means for avoiding over-grinding of the edges or extremities of the work.

1,115,778. November 3, 1914. **Recording Pressure Gauge.** Edgar H. Bristol, of Naugatuck, Conn., assignor to the Foxboro Company, of Foxboro Mass., a corporation of Massachusetts.

It has been found that solder used in pressure gauges of ordinary type causes a permanent "set" or deflection of the tube and pointer indicating incorrect pressure.

To overcome this defect or objection is one of the objects of invention, thereby securing a sensitive instrument that at all times will indicate and record the variations of pressure without appreciable error. Another objection to devices of this type, as hitherto furnished to the trade, is evidenced by the fact that they are constructed without simple means of adjustment for moving the tube about its center of motion or deflection; to cause the pen arm connected therewith to swing so that its pen may always coincide in its movements with the radial arcs of the chart.

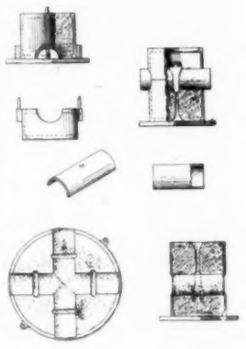


Another object of invention is to remedy this defect by providing simple means, as shown in cut, by which this adjustment may easily be made at any time, without calling in the aid of an expert or necessitating a return of the instrument to the manufacturers for that purpose or recalibrating.

1,115,905. November 3, 1914. **Means for Casting Finger Rings.** F. H. Curl, Long Beach, Cal.

This invention relates to casting molds, and more particularly to improved means for casting finger rings, and the principal object is to provide a separable mold to accommodate a pattern which extends beyond the sides thereof.

It is a further object to provide a mold, as shown in cut, for finger rings in which a support for the core is formed by the pattern upon which the configuration of the ring desired is also superimposed.



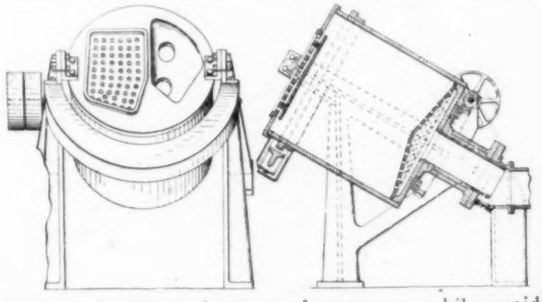
The inventor claims:

A device for molding objects having a ring configuration, comprising a cope and drag having a core seat extended through the sides thereof, a removable pattern to form a seat for a second pattern in said drag, a second pattern comprising a cylindrical body member, a ring pattern embracing said cylindrical body member, said body member being adapted to be seated in said seat in said drag formed by the first mentioned pattern to form a core-receiving seat in the cope, whereby the placing of a core within the seat completed by the cylindrical body portion of the second pattern in the cope and drag will form a space of the desired configuration of the ring pattern.

1,116,505. November 10, 1914. **Sand-Blast Apparatus.** William W. Sly, deceased, late of Cleveland, Ohio, by Wilfred C. Sly, administrator, of Cleveland, Ohio, and Wilfred C. Sly, of Cleveland, Ohio, assignor to the W. W. Sly Manufacturing Company, of Cleveland, Ohio, a corporation of Ohio.

This invention relates to a class of devices employed by foundrymen, whereby sand and scale may be rapidly and efficiently cleaned from the surface of even a very intricate casting, and this with the smallest possible cost for labor, power and materials.

The object of the present invention is the provision of an apparatus, as shown in cut, which shall render available the



desirable and efficient features of processes, while avoiding the objections inherent in each, and to this end the inventors have employed a combination of the two methods.

According to the invention the castings are revolved at a comparatively low speed in a modified form of tumbling barrel, while subjecting them to the action of a sand blast. The action of the tumbling barrel is to rotate and shift the castings so as to expose all sides thereof to the action of the sand and at the same time to collect and deliver to a suction conduit the sand, dust and scale removed by the abrasion. This sand and dust is then returned to a separating cham-

ber wherein the dust and small particles are removed and discharged while the sand is returned directly to the blast nozzle for second use.

1,116,702. November 10, 1914. **Process of Oxidizing Lead.** C. D. Holly, assignor to Acme White Lead & Color Works, all of Detroit, Mich.

This invention relates to processes of oxidizing lead; and it comprises a method of oxidizing metallic lead wherein finely-divided lead is oxidized by air in the presence of a solution containing the nitrate of an alkali metal as a catalytic or facilitating reagent, such nitrate being ordinarily subsequently regained as an alkali nitrate; such solution being advantageously a waste liquor derived from the manufacture of lead chromate and containing an alkali nitrate, such as sodium nitrate, as well as, usually, free nitric acid.

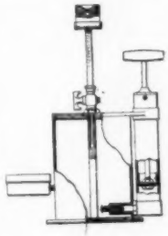
The inventor claims:

The process of making lead oxid which comprises exposing finely divided lead to the simultaneous action of air and alkali nitrate solution, recovering the lead oxid, and then converting such oxid into red lead by heat and oxidation.

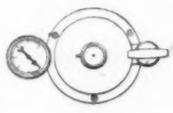
The process of making lead oxid which comprises exposing finely divided lead to the simultaneous action of air and sodium nitrate solution, recovering the lead oxid, and then converting such oxid into red lead by heat and oxidation.

1,116,720. November 10, 1914. **Metal-Casting Machine.** J. J. McGuire, Newark, N. J.

This invention relates to an apparatus for casting metal, and is adapted for use where the metal is flowed in its molten form into a cavity i nthe investment material of the mold, and is particularly adapted for the purpose of making inlays for dental purposes.



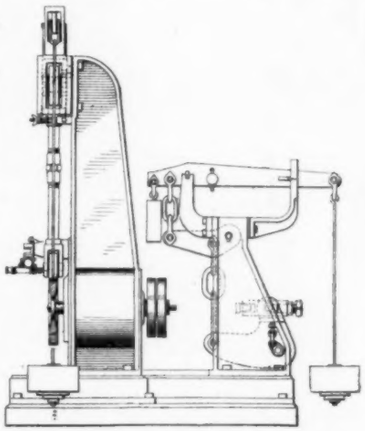
The invention is designed to provide an apparatus of this type, as shown in cut, which is complete in itself, embodying a vacuum chamber, a suction mechanism, a suitable indicator and flask support, all these being conveniently arranged, and being disposed to provide for economy in manufacture, and also arranged to facilitate the use thereof.



The apparatus further consists in so constructing the apparatus to use a minimum number of parts, and to construct the flask support so that it also acts to draw and hold together the parts of the vacuum chamber, whereby, if necessary, access can be easily had to said chamber.

1,117,187. November 17, 1914. **Machine for Measuring Friction.** H. Hess, of Wa Wa, Pa., assignor to the Hess Bright Manufacturing Company, Philadelphia, Pa.

This invention relates to mechanism for measuring friction between relatively moving parts, and more particularly in bearings of the type comprising inner and outer casing members and intermediate rolling elements, and the invention consists of improved mechanism comprising means for giving support to the parts to be tested, means for moving one of the parts, and means for subjecting the other part to load.



More specifically, and as applied to bearings comprising inner and outer casing members and intermediate rolling elements, the mechanism embodying this invention comprises means, as shown in cut, for supporting the bearing to be tested, means for rotating one of the casing members, and means for subjecting the other member of the bearing to load, acting either radially or endwise relative to the axis of rotation, or in directions oblique to said axis, the friction between the parts of the bearing, which under these conditions will tend to rotate the loaded member, being measured and determined by the degree of movement of said loaded member.

1,117,197. November 17, 1914. **White Enamel.** Ignaz Kreidl, Vienna, Austro-Hungary.

What is claimed is:

A white enamel containing, as a clouding agent, a metal compound suitable for clouding purposes in combination with alkali, the content of alkali metal being between 2 per cent. and 7 per cent.

A white enamel containing, as a clouding agent, a zirconium composition containing between 3 per cent. and 4 per cent. alkali metal.

A white enamel containing, as a clouding agent, a metal oxid suitable for clouding purposes in combination with alkali, the content of alkali metal being between 2 per cent. and 7 per cent.

A white enamel containing, as clouding agent, a compound suitable for clouding purposes, in combination with silicic acid and alkali, the content of alkali metal being between 2 per cent. and 7 per cent.

1,117,308. November 17, 1914. **Alloy of Aluminum and Process of Making.** T. A. Bayliss Warwick and B. G. Clark, of London, England.

This invention relates to improvements in alloys of aluminum containing aluminum, zinc and cadmium.

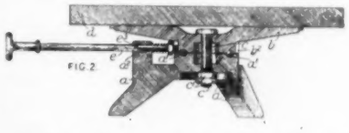
The invention comprises broadly an alloy composed of aluminum, zinc and cadmium which is malleable and which consists mainly of aluminum. More particularly the ingredients are present in the finished alloy in proportions between the limits of aluminum 80-99 per cent., zinc 0.001-19.999 per cent., cadmium 0.001-10 per cent.

A preferred method of manufacturing the alloy according to the present invention is as follows: The aluminum is melted in a pot or furnace, and zinc and cadmium are then added in their required proportions, within the limits set forth above, with or without the addition of a suitable flux. The whole mass is maintained in a molten condition until the zinc and cadmium have become evenly disseminated throughout the mass, and then allowed to cool. A modified method of manufacturing this alloy consists in first alloying the zinc and cadmium together in the proper proportions and adding this latter alloy to the mass of aluminum under the conditions described above to produce the required composition. The zinc and cadmium may be added either in a solid or molten condition to the aluminum.

RECENT ENGLISH PATENT

4648. Soldering. Mander, F. H., Aberview, Sherbourne Road, Acock's Green, Birmingham. [Class 83 (iv).]

A rotatable work-supporting table for soldering and like purposes, instead of being carried in the hand as in the apparatus described in Specification 7875/10, is mounted on a base connected by a ball bearing to the table portion, which may be locked in any desired position by a radial plunger engaging notches in the table. The table *b*, which may be star-shaped or solid, etc., to carry either a fire-brick top *d* or a bed of breeze, is connected to the base *a* by a bolt *c*, which may be secured by the nuts c^1 or by screwing into the base.



The ball-race a^1 may be formed as shown, or in separate steel portions fitted to the faces of the table and base. The table is formed with recesses b^3 engaged by a spring-pressed plunger *e* so as to lock the table in position. The plunger may be held in the disengaged position by the provision thereon of a peg e^3, which normally engages recesses in the bearing a^2, but which may be withdrawn and the plunger given a partial rotation. The plunger may have a screw or other control.

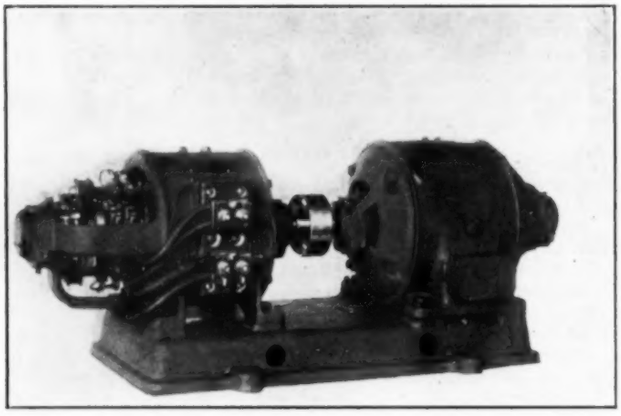
EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST TO THE READERS OF THE METAL INDUSTRY.

GENERATORS FOR ELECTROLYTIC WORK

The generator shown in the cut is manufactured by the General Electric Company, Schenectady, N. Y., to satisfy the demand from the majority of the larger plants devoted wholly or in part to electrolytic work for a reputable generator for electro deposition.

The low voltage and large current required for such work, as well as the uniformity of current necessary to obtain the gradua-



MOTOR-GENERATOR SET WITH SUB-BASE CONSISTING OF TYPE DEG.-1, 1KW. 1800-5 VOLT, 200 AMPERE GENERATOR AND TYPE CVC, 111-1.8 H.P. 1800-125 VOLT MOTOR.

tion of color-work, introduce difficulties into the problem of design which have only been overcome by extensive experience and careful study. The General Electric Company's generator is known as the DEG electrolytic generator, and as now manufactured is claimed to have many improvements over those heretofore offered for the purpose. These generators as offered for electro-plating and electro-typing are built in five sizes, and are of the four-bolt type.

The machines are run at moderate speeds, being those of the standard 60 cycle induction motors, thus permitting of direct connection, where alternating current at 60 cycles is available, and thereby saving a large amount of floor space and the first cost and maintenance of belting. They are cool under continuous operation at full load, and little affected by a change of load in the baths.

The DEG 1 and 2 generators are arranged for one voltage only, and consequently have only one commutator. These are self-excited generators, capable of giving voltages by variation of field strength from two to six at 250 and 500 amperes. The DEG 3 is of the double commutator construction, and is provided with an armature having two distinct windings, each connected to its own commutator. The terminals of the machine may be connected so that either the voltage of the output will be equal to the sum of the voltages of the two commutators and the current equal to the capacity of one commutator, or the voltage will be equal to that given by one commutator, and the current equal to the sum of the capacity of the two commutators.

By connecting the two armature windings in series these machines give twelve volts at the normal ampere output of one winding, or, if connected in multiple, will give six volts at twice the normal ampere output of one winding. The voltage may be reduced to four volts and two volts, respectively, by field weakening, giving the normal ampere output over the entire range in voltage. The DEG 4 and 5 are the same construction as the DEG 3, but are of larger capacity. The three-wire system of distribution, when used with these machines, effects a very large saving of copper, and a marked improvement of voltage at the tanks when work is introduced or removed.

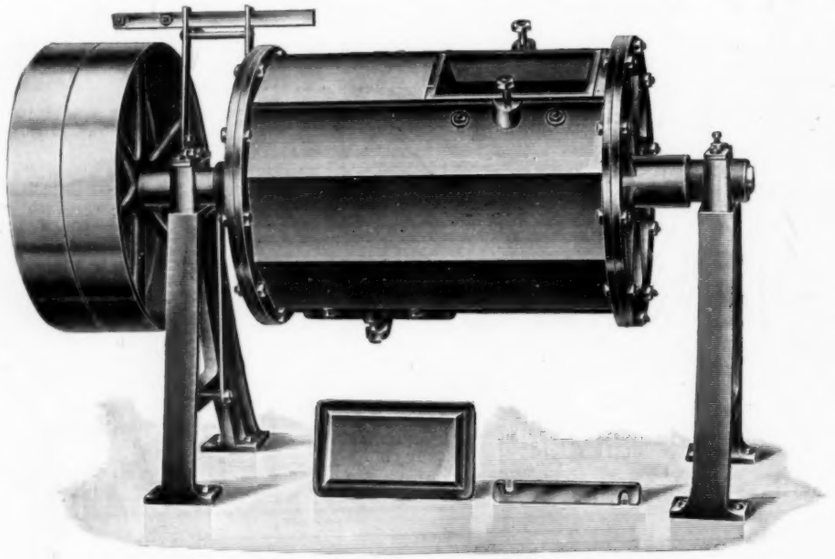
All of the standard electrolytic generators are shunt wound, the DEG-1 and -2 being self-excited, while the DEG-3, -4 and -5 are separately excited. It is sometimes desirable in electroplating, where more than one tank is operated from a single machine, to maintain a constant voltage under all load conditions without manipulating the field rheostat, and to meet these requirements the General Electric Company has developed the Type DT Form S2 voltage regulator, which may be used on any of the above machines to hold constant voltage.

Further information regarding these generators will be found in Bulletin No. A.-4093, and which may be had upon application to the General Electric Company.

TEN SIDED TUMBLING BARREL

The barrel shown in the cut is one of the medium sized cast iron tumbling barrels manufactured by Henderson Brothers, Waterbury, Conn. This barrel is used extensively for burnishing with hardened steel balls and fulfills all the essential requirements for such work.

It consists of a watertight iron barrel having ten sides and is lined with hardwood, the ends being removable for convenience when renewing the wood. There are openings the full length of the compartments so that all the contents can fall out when emptying.



HENDERSON TEN-SIDED TUMBLING BARREL.

The above barrel is interesting in that it shows the evolution

of apparatus for burnishing with steel balls in view of the present litigation regarding the origin of this process. THE METAL INDUSTRY in December, 1911, published an illustration and description of burnishing barrels manufactured by Henderson Brothers for the New England Watch Company in July, 1904.

The watch company had been trying in many different ways to polish main springs in a tumbling barrel; finding that irregular shaped pieces broke the springs, they tried steel balls. These balls having become rusted, they were put in the barrel for repolishing, and it was accidently discovered that some pieces of brass that were in the barrel with the balls became highly polished, and thus the idea of using steel balls for burnishing soft metals was hit upon.

Upon consultation with Henderson Brothers the correct and proper size of barrels for the work was finally decided upon, and the barrel shown here is the evolution of the one originally designed at that time. It is stated that the best results can only be obtained when the balls are as hard as they can possibly be made and the soap is of the right quality.

THE ILER DRAW CRUCIBLE FURNACE

This type of furnace is designed for consumption of either gas or oil and is adapted to melting and refining where it is desirable to pour metal out of the same crucible in which charge is melted. For a very small charge, such as may be desired in the melting room of a gold mill, or for base metal charge too large for transportation in a single crucible, a tilting furnace of special design is manufactured in which is embodied all the economic features of this furnace.

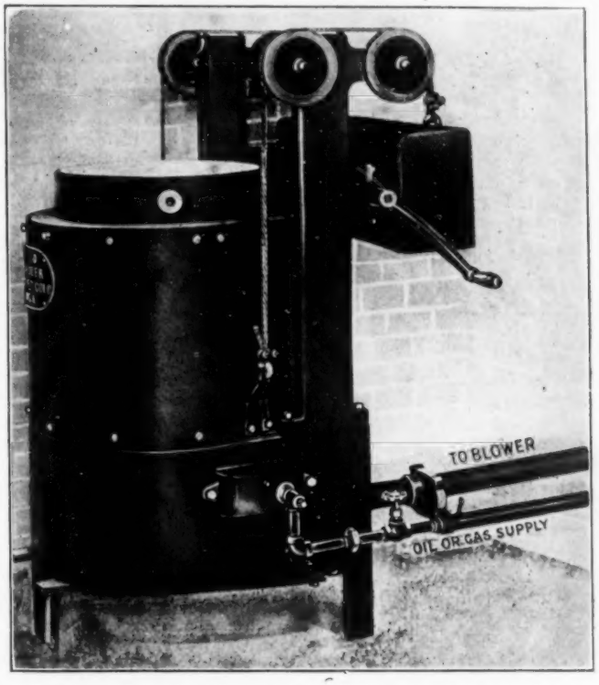
The furnace is cylindrical and in two parts. The lower part is the combustion chamber; the upper part is the crucible chamber. An air-tight seal is formed between the lower edge of crucible chamber and the combustion chamber, into which crucible chamber drops when furnace is closed. Within the walls of both main members is provided a conduit or passageway from blower to burner, air-tight joints connecting the two units. The combustion and crucible chambers are cylindrical and are lined with a refractory, of shapes designed to fill the exact area and key to place. In the combustion chamber is placed refractory stool or crucible rest. Mounted at rear of base are column guides with sheaves for cables to raise and lower crucible chamber by rack and pinion, a counterweight being provided to balance weight of crucible chamber, which is raised from and lowered to combustion chamber. The furnace designed for a No. 60 crucible is 34 inches high, and occupies a floor space of 2 by 4 feet, is provided with a

"PULLING A POT" IN THE ILER FURNACE.

swinging cover on top of furnace which admits of convenient access to crucible for stirring and additions to charges. The crucible is conveniently withdrawn by use of open-sided shank.

The air in its passage from blower to burner is forced through a conduit in the walls of combustion and crucible chambers, raised to a temperature of from 450-550 degs., and thereby reduces the temperature of the walls, gives thorough atomization of fuel and complete mixture of fuel and air, an essential point in the production of a short flame desired. The flame enters chamber tangentially, swirls about the stool and crucible, completely fills space around crucible and when adjusted properly does not measure in excess of 1½ feet beyond the flue in cover, as it here shows at night.

The temperature of the air at burner by pyrometrical readings is determined to be 450-550 degs. F., while temperature of brass melted is easily maintained at 2,100 degs. F. and much higher temperatures have been reached, as mild steel, requiring melting temperature of 2,400-2,700 degs. F. have



THE ILER FURNACE SHOWING FUEL AND AIR SUPPLY.

been made. Measurements have been made to determine the increase in efficiency due to the pre-heating of the air and with natural gas there was shown to be a fuel saving of 19.7 per cent. and with oil a much greater economy is apparent.

The No. 60 furnace weighs about 1,600 pounds and furnaces of this design are made in any size to accommodate any standard crucible of corresponding number. The only auxiliary equipment required for No. 60 furnaces is a blower that will deliver 180-250 cubic feet of air per minute at a pressure of 10-16 ounces. Other sizes would require proportionately more or less. During the past fifteen months these furnaces have been in constant use in a foundry turning out from 1,800 to 3,600 pounds finished brass and bronze castings per day and have proved efficient and economical, both in fuel consumption and a marked decrease in discomfort to operatives, and the refractory lining has been found durable, being cheaply and conveniently replaced when necessary. The furnace is manufactured by F. M. Iler, 242 West Florida avenue, Denver, Col.

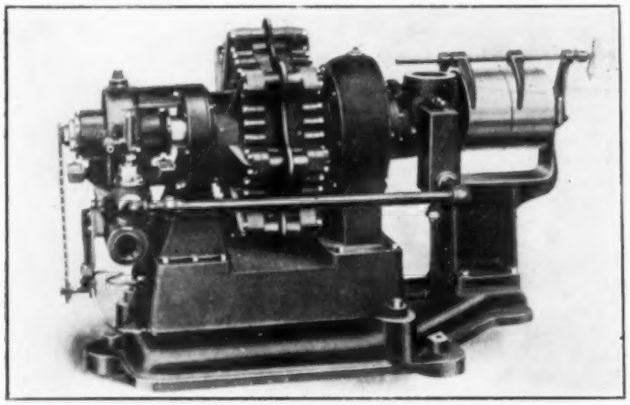
ROTARY AIR COOLED AIR COMPRESSOR

The Wernicke-Hatcher Pump Company, Grand Rapids, Mich., has recently placed upon the market the air cooled rotary air compressor shown in the accompanying cut and which is known as type B single stage power driven.

This air compressor operates on a new principle, by means of which both the rotor and rotor case revolve, one within the other, in the same direction and at the same velocity. Each revolves on its own axis in balance. Each pocket is provided with an intake valve and discharge valve, connecting through suitable passages with the intake and discharge passages in the hollow rotor shaft. The type B compressor, which is suitable for foundry work, the running of molding machines, cranes, hoists and other apparatus where compressed air is necessary,

has a capacity of about seventy-five cubic feet and requires twenty horsepower at the driving shaft to deliver this volume of air, 100 pounds gauge pressure.

Some advantages claimed for this type of air compressor by the manufacturers are as follows: It makes possible the most



THE ROTARY AIR COOLED COMPRESSOR.

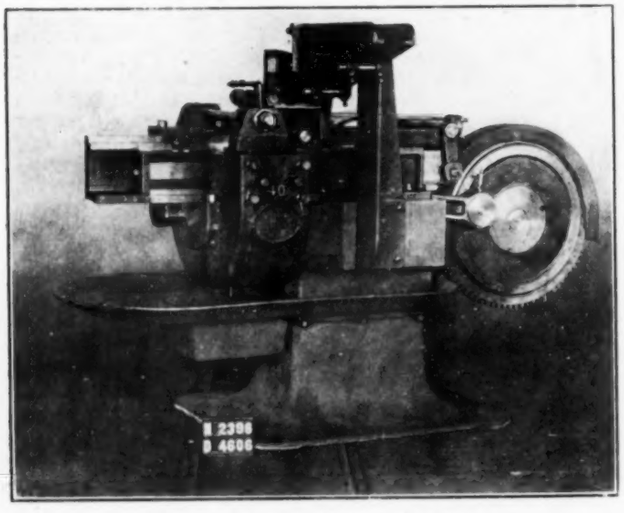
effective and reliable cooling system ever applied to an air compressor; it permits the advantages obtained by rotary motion, as all heavy moving parts are balanced and rotate at uniform speed. Constant and continuous compression equalize all strains and bearing pressure, and finally it permits effective sealing of air at high pressure.

They also state that owing to the great flexibility and adaptability of the machine it operates automatically and requires practically no attention.

Further information may be obtained by corresponding with the manufacturers.

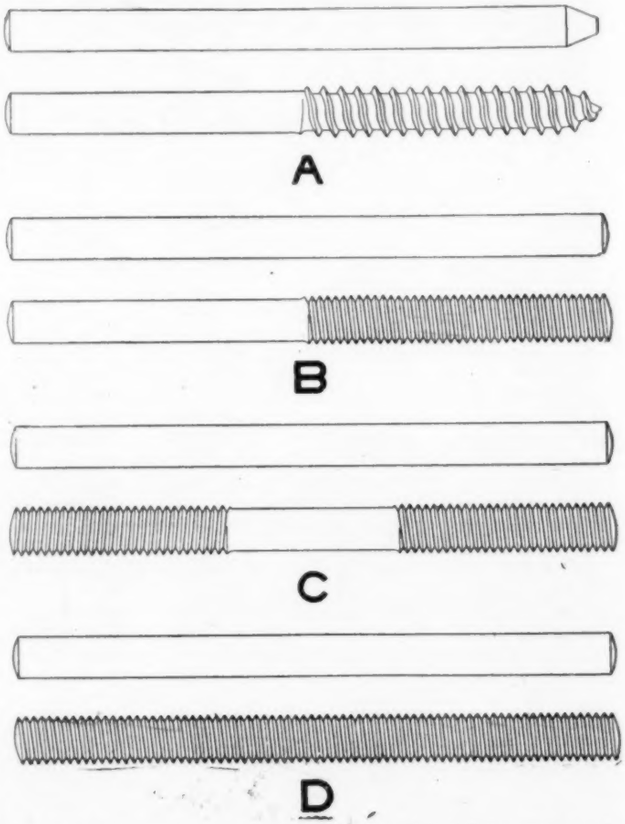
SCREW THREAD ROLLING MACHINE

The machine shown in the illustration is one of a line of special reciprocating screw thread rolling machines brought out by the Waterbury Farrel Foundry & Machine Company, Waterbury, Conn., to meet the demand for a special thread rolling machine having extra deep dies. They are used for rolling a greater length of thread than can be done on their standard screw thread rolling machines and they have the good features of the standard machines combined with other



SCREW THREAD ROLLING MACHINE.

improvements. Special care has been taken to preserve the good features of great stiffness and rigidity in the frames, and in addition, extra strength is given on these special depth die machines by tie rods at the part of the frame where the strain comes while the threads are being rolled. These rods prevent springing of the frame when threads of considerable length are being rolled and insure a correct and accurate thread the entire length. Machines of this type are built for both hand feeding and automatic magazine hopper feeding for headless blanks. In hand feeding the machine the work is placed in front of a starting slide plate resting on an adjustable depth gauge which is set to give the length of thread required. The blanks, at the proper time, are pushed forward and gripped by the moving dies and the threads are rolled. The magazine feed is built for feeding headless blanks that require either threading on one end, both ends or the entire length simultaneously. This type of feed is especially adapted for threading such pieces as are used in harvester



A is an illustration of work with gimlet point threads rolled on one end of blank.

B is an illustration of work with machine screw threads rolled on one end of blank.

C is an illustration of work with machine screw threads rolled on each end of blank with right and left hand threads.

D is an illustration of work with machine screw threads rolled the entire length of blank with either right or left hand threads.

machinery, electric screws, skate screws, turn buckle screws, special bolts, etc., and such work as may require one end to have a right hand thread and the opposite end a left hand thread. Of course, when threads are rolled simultaneously on each end of blanks the diameter and pitch must be the same. Where the threads are rolled simultaneously on each end of work with a blank portion remaining between the threaded portions the dies are separated with a filler or a number of fillers to make up the distance that is desired to be left not threaded. The dies can be used to roll either right hand or left hand threads as desired. The machines are built with pump, tank and lubricating system for flooding the dies with lubricant while the work is being threaded. These machines are built in sizes having capacities up to and including one inch diameter. The illustration of samples shows some of the different styles of threading blanks for which these machines are adapted.

NEW GAUGE SYSTEM

A new electrical long distance transmitting, incidating and recording system is being placed on the market by The Bristol Company, Waterbury, Conn. In these instruments* Bards patent long distance induction balance movements are employed as especially developed for this purpose by the Sangamo Electric Company. Bristol recording instruments when equipped with these electrical transmitting systems are capable of producing automatic and continuous records of pressure, liquid levels, temperatures, mechanical motions, etc., at long distances, even many miles from points at which the transmitters are located.

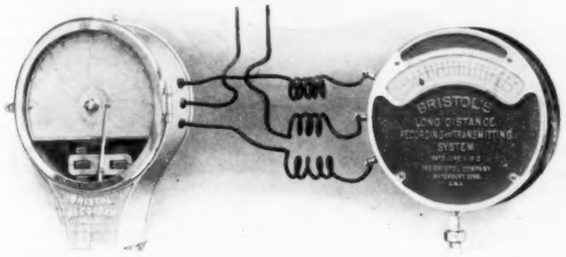


FIG. 1. LONG DISTANCE PRESSURE RECORDING SYSTEM.

Fig. 1 shows a standard unit of these transmitting and recording instruments, including the transmitting indicator for installation at the point where the pressure or temperature, etc., is measured, and the receiving recorder which is installed at the remote point where it is desired to have a record produced.

The two instruments are shown connected by three wires, one of which is connected to a source of alternating current, as, for instance, a lighting circuit.

This long distance system is particularly well adapted for use under ordinary operating conditions because of its simplicity of construction. There are no sliding or make and break contacts employed, and the effects of variation of temperature or resistance along the circuit are negligible. The recording instrument may be installed many miles distant from the measuring and transmitting device. For instance, if 110 volts and No. 14 copper wires are used, the recorder may be located thirty miles from the transmitter, or if No. 12 leads are used the recorder can be installed forty miles or more from the transmitter. The transmitting device is mounted in moisture proof case, and can be installed outdoors if necessary, as for instance, on the bank of a reservoir.

The needs for such equipment are numerous in connection with water works, central heating stations, hydro-electric plants, gas distribution systems and irrigation projects.

The fundamental principle of the Bristol long distance transmitting and recording system is that of the induction balance. The transmitting instrument and the receiving instrument are each equipped with two pairs of coils arranged to swing in a horizontal plane over iron cores. Fig. 2 shows the interior of one of the transmitting instruments. In this instrument the helical form pressure tube and the electrical transmitting device are shown in the operating position.

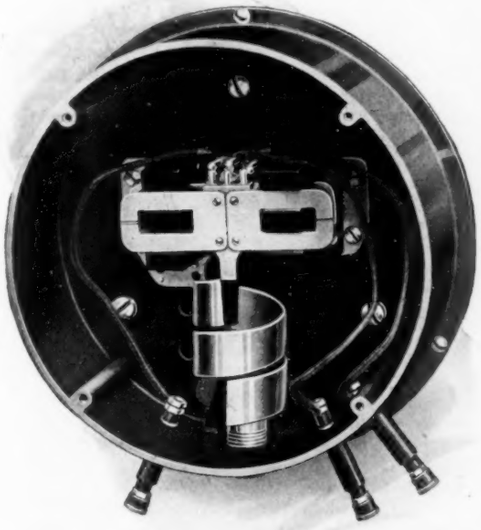


FIG. 2. SHOWING THE INTERIOR OF THE TRANSMITTING APPARATUS OF THE BRISTOL GAUGE.

NEW BROWN INSTRUMENT FACTORY

The Brown Instrument Company have recently moved to their new factory at Wayne Junction, Philadelphia, which has been fitted up with an idea of having the most up-to-date facilities for manufacturing instruments of precision. The building is particularly light, windows being on all four sides, with skylight through the center, as light is essential where fine work is to be done, such as is necessary where parts of electrical instruments are to be assembled. The new building is two stories in height; first floor being occupied with the offices, locker room, packing room, engine and boiler room and raw stock room.

The second floor is devoted entirely to manufacturing, the laboratory being located at one end of the building, and the machine shop department at the other. Stock rooms run down the side of the machine shop and laboratory, where all small parts necessary for the manufacture and assembling of the instruments are kept at hand. Electric furnaces are installed in the department for standardizing thermo-couples, and also in the experimental department and inspector's office, so that thermo-couples can be accurately standardized after assembling.

SECTION OF LABORATORY BROWN INSTRUMENT COMPANY WITH EQUIPMENT FOR ACCURATELY STANDARDIZING INSTRUMENTS.

In Fig. 1 a section of the laboratory is shown, and some idea of admirably light building is given. The Brown Instrument Company is always glad to show any of their customers through the new factory, and they will be always welcome at the new plant when in Philadelphia.

THE ECONOMY OF COPPER CYANIDE

By Carl Dittmar.*

Of late, copper cyanide has been the subject of considerable discussion, and its advantages have been questioned, especially as far as comparative costs are concerned. It is hardly possible for anyone to doubt the advantages or greater efficiency of copper cyanide as compared with copper carbonate heretofore used. Both materials are based on the same theory, and this being the case, copper cyanide is to be recommended for making up new solutions as well as for replenishing plating baths which have formerly been made up with copper carbonate.

Any copper salt, to be in condition for plating in a cyanide solution, must be in a cuprous state. The copper carbonate, so called, is a basic sulphate or a cupric salt; hence this cupric salt must be converted into a cuprous salt before it is of service to the plater. When the plater "cuts down" copper carbonate with cyanide, he, in reality, forms copper cyanide, but at the same time he adds to his solution 50 per cent. of impurities and inert matter, such as carbonates and sulphates. Copper carbonate tests approximately 50 per cent. copper. The essential ingredients of a copper bath are metal and cyanide. The large proportions of impurities which have heretofore been added with the copper carbonate have had no bearing on the deposit, but have simply added a further element which the plater had to take into consideration when regulating his solution. The plater has long demanded chemically pure materials for his solution, but in the past such chemically pure salts have, of necessity, been high in price. Within this year a new process has been perfected by which chemically pure copper cyanide can be made at a price comparing most favorably with the less satisfactory carbonates heretofore used. For instance, copper cyanide, testing 70 per cent. metallic copper and 30 per cent. cyanogen, is now on the market at a price of from 42 cents to 45 cents per pound. The plater at once saw the advantages of copper cyanide, realizing that he was now able to make up a solution containing metal and cyanide only. He realized, for the first time, that he had a solution which he could regulate with absolute certainty. The solution, containing only the active elements, made it necessary to watch only the cyanide contents and metal in solution. Under certain conditions, the metal is drawn more freely from the solution than can be supplied by the anode, necessitating a further addition of copper cyanide to bring the bath back to standard.

Again, there are times when the cyanide is decomposed. The solution then requires the addition of cyanide. In other words, there are only two ways that the solution requires replenishing, either cyanide or metal. When using the carbonate, the plater often groped in the dark, as the constantly increasing impurities in his solution due to the carbonates and sulphates caused trouble. In fact, especially in barrel plating, the solution oftentimes had to be diluted and large quantities had to be thrown away. With the metal cyanides the bath remains free from inert matter at all times, the only addition being through the decomposition of cyanide and the resulting formation of carbonates in solution. This, however, occurs only in a very small degree; in fact, a solution made with these chemically pure salts is the only solution that will give uniform results indefinitely, day in and day out. I would like to point out here that the so-called carbonate of copper is not a standard product. It varies in metal contents; in fact, no two lots test alike. Copper cyanide, on the contrary, is always uniform, always testing 70 per cent. metal. In short, copper cyanide is theoretically and practically correct, while carbonate of copper is not. It is easy to understand why the plater has been working against great odds with the use of carbonate of copper, as he never was absolutely sure how much metal he was introducing into his bath.

The plater, having satisfied himself as to the theoretical and practical correctness, next considers the question of cost. On its face, copper cyanide appears to be expensive, taking as a basis the price of 42 cents per pound for the copper cyanide and the price of 14 cents per pound for the carbonate of copper. Even considering the decided advantage of the copper cyanide and its larger proportions of metal, the cost of copper cyanide appears excessive. The plater must, however, consider that copper carbonate, or copper cyanide as such, is absolutely valueless; they only obtain a monetary value as far as the plater is concerned when they are put in solution. Neither copper carbonate nor copper cyanide is water-soluble. The question, therefore, is how much cyanide is necessary to dissolve copper carbonate as compared with the quantity necessary to put copper cyanide in solution. The plater sells metal—the metal that he deposits on the cathode—and hence his greatest problem has been, and will continue to be, "How can the metal be put in solution most economically?" One pound of copper cyanide, containing 70 per cent. metallic copper, costs about 42 cents. To put the same in solution and still retain sufficient free cyanide to obtain instant working of the solution, one pound of sodium cyanide is necessary. Taking a price of 22 cents per pound for the sodium cyanide, the cost of 100 pounds of copper cyanide, 70 per cent. metal in solution costs $64. To obtain the equivalent amount of metal in the form of copper carbonate, 50 per cent., it is necessary to use 140 pounds at a price of say 14 cents per pound, the cost being $19.60. To dissolve this thoroughly so that no precipitate forms and the solution still has sufficient free cyanide, that is 3 to 5 per cent., it is necessary to use 239 pounds of sodium cyanide. The cyanide cost, on the basis of 22 cents per pound, would be $52.50, making the total cost of the equivalent metal content put in solution ready for plating $72.18 This shows conclusively that the metal cyanides are the more economical of the two materials to use.

In addition to this obvious economy there is a further saving, which will appeal to the efficiency man. This is due to the fact that copper cyanide is the most highly concentrated copper salt possible, and the plater is, therefore, enabled to introduce a larger proportion of metal into his solution. As every plater knows, especially those engaged in barrel plating, more metal in solution enables the plater to obtain quicker deposits, and it is safe to say that with the metal cyanides the plater can cut down the time of deposit about one-third. This quicker deposit results in an increased output, without increasing the tank area or current density. There can, therefore, be no question as to which material is the more economical when we consider that with the metal cyanides the plater can make up a solution free from inert matter of every description, a solution which will enable him to increase the output of his tank and reduce his time of deposit, especially when such a solution is made up and maintained at a saving in dollars and cents.

*Manager, Metal Cyanides department The Roessler & Hasslacher Chemical Co., New York.

RUST-PROOFING BY CALORIZING

A recent issue of the General Electric Review published by the General Electric Company, Schenectady, N. Y., gives a very interesting account of the new process that has been discovered for the protection of iron and other metals from the effects of high temperature and which is called calorizing.

The oxidation and scaling of both iron and copper, it is claimed, is overcome by this new process. The metal to be protected is packed in or painted with a mixture containing, among other things, finely divided aluminum and heated while being tumbled so that a skin consisting of an aluminum alloy is formed over the metal under treatment.

The apparatus consists simply of a revolving drum in which the metal to be treated is tumbled and which is filled with a mixture containing, among other things, aluminum in a finely divided state. The drum is highly heated so that the two metals unite as an alloy. In the case of copper this alloy is of the nature of an aluminum bronze, but is richer in aluminum and more resistant to heat than the ordinary alloy of that name. After iron is calorized the effect of heating is slight, and there is none of the burning and scaling that occurs when untreated iron is subjected to high temperatures. The process has already been used successfully for iron and copper vessels of various kinds, as well as for copper soldering irons and iron resistance wires used in heating devices.

Associations and Societies

REPORTS OF THE CURRENT PROCEEDINGS OF THE METAL INDUSTRY ORGANIZATIONS.

AMERICAN ELECTRO-PLATERS' SOCIETY

New York—The November meeting of this branch was held Friday evening, November 27, at the Broadway Central Hotel. A committee was appointed for the New York branch to consult with the Newark branch to settle upon definite features for the annual banquet which will be held at the Broadway Central Hotel, February 20, 1915. William Schneider is chairman of the banquet committee.

Newark—The annual whist and dance will be held at Oraton Hall, Newark, N. J., Friday, January 15, 1915. Tickets may be had from members or L. H. O'Donnell, 163 Lembeck avenue, Jersey City, N. J.

Bridgeport—A demonstration of the metal cyanides will be made at the meeting of the Bridgeport branch, December 18, to which not only members are to be invited, but also all platers who are not members. This invitation is the outcome of considerable discussion which has arisen over the efficiency and economy of the metal cyanides, and not only will the salts be demonstrated in practical solutions, but also a paper will be read covering the questions thoroughly. After the reading of the paper a general discussion is to take place. In connection with this meeting there is to be a "Dutch supper" served in the meeting hall, and it is expected that platers from all parts of Connecticut will attend.

Cleveland—A meeting of the platers of Cleveland, Ohio, and vicinity was held at the Y. M. C. A. building, Saturday evening, November 21. William D. Scott was appointed chairman pro tem and Charles Werft, secretary pro tem. Mr. H. J. Ter Doest addressed the meeting on the benefits which could be derived by becoming a member of the society. Every plater who was in attendance and who was eligible to become a member of the society made application for membership. Mr. Werft was authorized to make application to the Supreme Society for a temporary charter. The next meeting of this branch will be held on Saturday, December 5, 1914, at the Central Y. M. C. A., at which time the election of officers will be held and papers will be read on nickel plating, with discussions following.

AMERICAN ELECTRO-CHEMICAL SOCIETY

Joseph W. Richards, secretary, reports that the date of the spring meeting has not been definitely decided, but it is provisionally set for April 22-3-4, 1915. The meeting will be held at Atlantic City, N. J., and judging from the success of the one held there two years ago a good attendance is assured.

AMERICAN FOUNDRYMEN'S ASSOCIATION

Secretary Backert announces that it has been decided to hold the next meeting at Atlantic City, N. J., during the week of September 27, 1915. The exhibit of the Foundry and Machine Exhibition Company will be held on the steel pier and the meetings of the American Foundrymen's Association and the American Institute of Metals will be held in the meeting room on that pier.

PERSONALS

ITEMS OF INTEREST TO THE INDIVIDUAL.

ATHLETIC W. H. PARRY

Every reader of THE METAL INDUSTRY has no doubt been entertained and instructed by the spirited writing of W. H. Parry, a character all his own and who is incidentally superintendent of the National Meter Company, of Brooklyn, N. Y.

Mr. Parry has recently reminisced when he spied an item in a daily paper that his protege walker, Young Renz, had won a twenty-five-mile championship from a field of fifty-four starters and that in two months Renz had won five championship races. Young Renz was trained by Mr. Parry, mostly by correspondence. The Brooklyn superintendent has therefore started an Athletic Correspondence School.

In recalling sports of thirty years ago Mr. Parry mentions that he was at that time a heel and toe artist, usually finishing in the front rank and at that time the walkers practiced the sport for the sake of the sport alone.

They had no training tables in those halcyon days and there was no taint of profession, as every man paid his own expenses, unless he was a member of one of the few rich athletic clubs, and about all the athletes received even of the rich organizations was their bare traveling expenses. Nowadays the performers have paid coaches, training tables, all expenses paid, etc., and Mr. Parry believes that in this respect the colleges, great and small, are today the worst transgressors.

He mentions that he could tell some tales of professionalism in college sports and then, to think of it, some of the colleges train their students for the ministry.

No doubt Mr. Parry's early training in the athletic field accounts in part for his vigorous mental ability whenever he takes up the pen. He wields one mightier than the sword.

MAJOR DARWIN BATES

Among the men connected with the metal industry who are in service in the present European war is Major Darwin Bates, one of the proprietors of the Bates & Peard Annealing Furnace Company, of Huyton, near Liverpool, England. Major Bates, for some time past, has been training volunteers at Edinburgh. George W. Peard, the other member of the Bates & Peard Company, reports that while in some trades in England there is a depression, due to the war, in others there is a marked increase in business, especially in those trades where German and Austrian manufactures, until recently, have been purchased by the neutral European markets. The British Insulated & Helsby Cables Co., Ltd., the company with which Messrs. Bates and Peard are connected are particularly busy, having accepted some very large orders for wire for shipment to countries which were formerly supplied by Germany. Nearly all of the departments of the plant are working day and night. The company is having difficulty in finding sufficient labor for the carrying on of the work.

Franklin S. Cobb, formerly one of the proprietors of the New Era Lustre Company, and who has been in the lacquer business for twelve years past, has recently connected as salesman with the Maas & Waldstein Company, lacquer manufacturers, 92 William street, New York, N. Y. This company has manufactured lacquers for a number of years, and Mr. Cobb announces that he is in a position to take care of all his former customers through his situation with the Maas & Walstein Company. The New Era Lustre Company has been absorbed by the Anderson Chemical Company of Passaic, N. J.

Franklin A. Taylor, prominently connected with the brass manufacturing business of Waterbury, Conn., for twenty-five years, was, during the latter part of October, elected president of the Riverside Metal Company, Riverside, N. J. The Riverside Metal Company manufacture special high-grade metals and employ several hundred hands.

G. C. De Witt, of Brown and De Witt, agents in the United States for Waldberg & Company, Paris, France, manufacturers and dealers in electro-plating supplies, has associated himself as efficiency engineer with the Splitdorf Magneto Company, Newark, N. J.

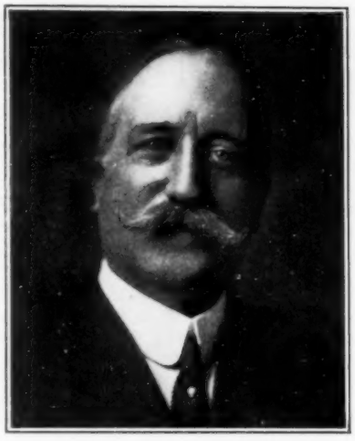
Royal F. Clark, who has been for the past six years foreman plater of Thomas J. Dunn Company, New York, has taken charge of the plating, polishing and lacquering departments of the Eagle Glass & Manufacturing Company, Wellsburg, W. Va.

Roy Woods, formerly superintendent of the New Jersey Tube Works, at Harrison, N. J., has become connected in a similar capacity with the Cheshire Brass Company, Cheshire, Conn.

DEATH

GEORGE L. WHITE

G. L. White, of Waterbury, Conn., one of the most prominent manufacturers of this city, died of apoplexy at his home December 1. Mr. White was 62 years old and had lived in Waterbury from early youth. Up to the time of his death Mr. White had the following business connections: President of White & Wells Company, of Waterbury; president of the L. C. White Company, of Waterbury; president of the Fuller-Burr Company, of New York City; president of the Wm. B. Van Buren Company, of New York City; former president of the New England Watch Co., of Waterbury; vice-president of the Philadelphia Paper Manufacturing Company, of Manayunk, Philadelphia, and director of the Colonial Trust, of Waterbury, and director of the Dime Savings Bank, of Waterbury.



G. L. WHITE.

Mr. White is survived by his wife, three children and five grand-children.

Trade News

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS AND TRADE ITEMS OF INTEREST FROM THE DIFFERENT INDUSTRIAL CENTERS OF THE WORLD.

WATERBURY, CONN.

DECEMBER 7, 1914.

November has been an exciting month in Waterbury because of events which concerned the metal industries, but it has not been a particularly pleasing period for either employers or employes, or those seeking employment, for whatever improvement there has been has been very slight. War orders have helped business a little. The taking over of the old New England Watch Company's plant by Robert H. Ingersoll & Bro., after a most unusual comedy of errors in which the municipal government played an unusual role, and the starting of a small new industry, The Standard Tool Company, here, were the most exciting events. Overshadowing all was the excitement caused by the offer of the Ingersoll concern for the watch shop.

At a Chamber of Commerce dinner, Monday, November 23, Charles H. Ingersoll, treasurer of Robert H. Ingersoll & Bro., appeared by invitation, to explain his company's proposal and to remove doubts as to whether the company intended to use the plant or to dismantle it. He was coolly received, but made it plain to the dinner party that the company did intend to make watches in the plant and to begin operations in it as quickly as possible after the deeds passed. In six months, he said, probably 100 hands would be employed; at the end of a year, probably 500, and soon after that, he hoped, the full complement of the shop. Tuesday morning the Ingersolls were declared the successful bidders for the property when court opened.

The deeds for the transfer of the property from the receivers to the Ingersolls have been approved by the court. The sum of $5,000 is to be paid December 4, to bind the bargain, and the Ingersolls will have possession of the plant where the famous Waterbury watch came into existence, in a few days. In it they intend to make watches of about the same styles as the New England watches, but of better grade, and the city is rejoicing that the plant is to be reopened as a watch shop.

This step will in no way interfere with the manufacture of the Ingersoll dollar watches at the plant of the Waterbury Clock Company, so that the industry is regarded as a real successor to the New England Watch Company.

Business in the machine shops continues good, owing to rush orders for war goods, but there is no demand for labor. The Waterbury Farrel Foundry & Machine Company is busy on machinery for New England plants which manufacture cartridges and war munitions. The E. J. Manville Machine Company also is busy on machinery orders. The Scovill Manufacturing Company is busy on war munitions, iron and steel shells, and its activity is helping some other plants in the valley which manufacture brass and copper tubing of large size. Few other concerns are enjoying even a brief boom. There really is a slight improvement, generally, but widespread lack of confidence and weakness of demand takes all satisfaction out of it. There are hundreds of workmen waiting for a chance to earn a day's pay on the boss's terms every morning of the week.

Thomaston's watch and clock shops are apparently at the lowest point in years, as regards activity, and the town feels it. The Plume & Atwood Manufacturing Company's plant there is the more active of the two, and that is moving sluggishly, though prepared to speed up when the orders come in. Interviews with the manufacturers indicate that while the outlook has nothing bright in it, the advances in copper and brass prices in the past few days have brought cheer, and if all signs work out by rule, there should be some tangible improvement in brass business soon.

There is one fine feature about it all, and that is that the manufacturers are standing the strain well and seem to be determined to weather the gale without losing a sail. It is a splendid showing that they have made under the severe tests of the past few months, and the fact that their industrial and financial health has proved itself so sound is sufficient to insure the full benefits of prosperous conditions when they return.

South American trade is not very inviting yet, and there is no appearance of any progress towards converting that market to New England. What business is done is generally cash in advance, and those terms are likely to prevail for a long time. The war is but another reason why these terms should be considered the only safe terms, especially in countries where the financial currents are controlled by European bankers. There are shipments going from here to South America, but they are not necessarily destined to customers on this side of the Atlantic.

The deaths of Nicholas Jenkins, who was prominent once as a designer and assistant superintendent of the Holmes, Booth & Haydens Company, now a branch of the American Brass Company, and George L. White, a former president of the New England Watch Company, November 30 and December 1, respectively, removed two prominent figures in local industries.—F. B. F.

NEW BRITAIN, CONN.

DECEMBER 7, 1914.

Speaking broadly, it may be said that, while there is no great prosperity boom prevalent in New Britain, general business conditions have picked up to an appreciable extent during the month just passed. This statement is, however, one which covers a wide scope and while it will not apply to each and every individual concern still it is a fair summary of conditions as they exist today.

Regarding the plans of the local manufacturers along the lines of increasing their business in South American cities, but little can be said at the present time. Approached on the subject the hardware managers here state that they are unable, as much as they would like to, to do much in South America at present because of the financial situation existing there. This is particularly true at the Stanley Works and the Stanley Rule & Level Company, and until the big American bankers get firmly established there to pave the way their efforts will be fruitless. At present the money exchange must be made through Europe, as there is no American bank there. Then the war came along and ruined even the foreign banking interests and, until the United States bankers become settled there and redeem the existing chaos, the manufacturers can look for but little increase in their South American trade. Even the fair trade that some concerns have there is greatly hampered by the absence of a single American bank on the continent.

In stimulating trade the European war has had but little effect on local conditions. As the majority of all articles made here are either cutlery, machinery or hardware there is but little opportunity for war sales. Nevertheless, while it may not be traced directly to this war, the fact remains that not long ago the North & Judd Manufacturing Company, makers of bits, spurs, buckles and all sorts of harness trappings, received a large order from the government. Another order from the Greek government had been given to the Waterbury Tool Company. This is a large contract for automatic speed gears, monster hydraulic contrivances used in turning the turrets on the battleships. But the most positive result of the war is being reaped by the Berlin Construction Company. This concern is working night and day and is rapidly finishing a big order given them by the Union Metallic Cartridge Company, of Bridgeport. This Bridgeport concern is rushed in making amunition for the belligerents, and it is to assist them that the local concern is working.

The recent election proved a landslide for the Republicans in the State and particularly in New Britain, where the entire G. O. P. ticket was elected by an overwhelming majority. Practically all of the captains of industry here are staunch Republicans and for several months before election business fell flat. The Republicans are now victorious and the cry is "business will pick up again after the first of the year." Whether this is due to any political influence or not is merely a conjecture. But as to the depression caused by the war the writer can state more positively, for it is a known fact that most of the concerns and especially the Stanley Rule & Level Company, which has an extensive foreign trade, and the Landers, Frary & Clark Company, which not only has a big export trade, but also imports considerable raw material from across the Atlantic, have felt the effect of the strife terribly, as can be seen from the short hours the employees work. At other shops where trade or materials are not affected the tightness of the money market, resulting from the war scare, has had a tendency to paralyze their t ade.

So rapid has been the erection of the new seven-story concrete building of the Stanley Works that, although ground was only broken on August 5, the structure was ready for occupancy by December 5. This new building is one of several that this concern has planned for the future and plans have already been made for the extension of Stanley Works property during the next twenty-five years if business conditions are favorable. This latest addition is 202 feet by 62 feet by 91 feet and is designed to carry a weight of 500 pounds per square foot. Little new machinery will be installed, but it will relieve the congestion in other parts and more space can be devoted to storage purposes. "Safety First" is the motto at this new building and in addition to being erected with this view in mind the lighting system is as near perfect as possible, the entire sides of the structure being almost a mass of windows.—H. R. J.

BOSTON, MASS.

DECEMBER 7, 1914.

General industrial conditions continue slow in Boston and the surrounding cities and towns, many plants being operated at less than 75 per cent. of their normal capacity. Among the nickel and silver platers there is only a moderate amount of business and the brass workers, as a rule, are not rushed with orders.

Inquiry among the large manufacturers of copper and brass goods brings out the information that none of them is obtaining new contracts now as a direct result of the European war, and very few can trace indirect favorable results to that source. It is believed, however, that some orders may be obtained while the conflict is in progress, inquiries from abroad being noted in certain quarters.

A factor of some consequence in connection with the production of copper kettles and other accessories for distillers is the increasing demand for alcohol to be used for mechanical purposes. This promises to broaden in importance before the conflict ceases.

Very little new building in this section is reported. Therefore the contractors on large construction work are taking far less interior finish in brass and copper, and the steamfitters, gasfitters and plumbers, whether on ordinary or high-grade work, require much less in their respective lines. Chandeliers, toilet room fittings of nickel, brass or silver, and builders' hardware of all kinds are in unusually light request.

Dealers in sheet copper for boilers, sheathing and cornice work likewise feel the dull period's effect upon their trade. While there has been, perhaps, a small amount of export demand annually in recent years for goods to be shipped to Canada, little has been noted from other directions, and no new business with Europe or South America is known to have been sought lately by firms here.

Political and banking obstacles are considered of more influence on the local situation at present than the war, although it is calculated that the latter may become more potent in a short time, in view of the placing of contracts here in other than metal lines in greater volume recently by some of the belligerents. Stimulus to various other producing shops, including metal-working plants, seems likely to result from the diverting of several products to export trade.

Fire on November 24 at 349-357 Cambridge street, West End Section, damaged the plants of the Jones-Bertsch Company, makers of lighting fixtures, and of the Yardley Bronze Company.

Many manufacturers and representatives of different boards of trade and commercial associations in territory served by the New York, New Haven & Hartford Railroad Company were guests of the railroad management the first week in December at a South American trade conference in this city. There was a luncheon, followed by addresses and a discussion of South American trade possibilities.—T. S. B.

ATTLEBORO, MASS.

DECEMBER 7, 1914.

The manufacturing jewelers of Attleboro, while appreciating the enormous business possibilities of South American

trade, are not rushing headlong into the proposition, but are following the advice of those who know the conditions in that country and who realize that it will be some time before South America is prepared for the wholesale shipping of American jewelry.

The Attleboro Sun, a local newspaper, printed a special edition a few months ago in which a section was given over to South America. The Sun laid emphasis on the fact that this was a period of preparation for South American trade. Several of the manufacturers have taken the matter up and have been trying to locate reputable South American representatives. While it is quite probable that the jewelry industry will be benefited by Southern trade, the manufacturers do not look for any great flow of business for some time to come.

There are no firms in this section which have benefited by orders for war materials or supplies. Several representatives from English jewelry firms have been here during the past few weeks placing orders for goods which were formerly supplied by Germany. The orders while not large laid a foundation for European trade which will be fostered and may develop into something of importance.

Business in the factories remains the same as usual—less than normal. The war, which is blamed by some for the bad business conditions elsewhere, is not held reposible in this city. The only manufacturers who are feeling the effects are those who use precious stones. It is impossible to import these stones and the local factories are practically at a standstill or are using imitation stones.

At the election, November 3, Attleboro voted to accept the city charter, making it the thirty-fourth city in the State and thirty-first in population and nineteenth in industrial importance. The city election will take place December 8. For mayor Harold E. Sweet, the treasurer of the R. F. Simmons Company, and James H. Leedham, Jr., a lawyer, are candidates. Other manufacturers have entered the council race, together with other representative citizens of the town, and from present indications it would appear that the new city will have a councilmanic body to be proud of.—C. C. C.

PROVIDENCE, R. I.

DECEMBER 7, 1914.

The European war has caused an increasing activity among the various metal lines and their dependencies, as well as among the several foundries and machinery manufacturers in this vicinity. Some concerns are depending entirely upon the accession of war orders to keep things moving, while others report good business on regular and normal lines.

A more cheerful sentiment and a more hopeful outlook on the business situation has been experienced by the Brown & Sharpe Manufacturing Company during the past month and it was stated by one of the officials a few days ago that for the past six weeks conditions have been improving to an extent that warrants a much more optimistic view of the situation than for many months previously. While the new business has called for the taking back of only a few more men, it has been a decided step forward and indicated a change for the better, it was pointed out. It was also pointed out that while some of the business is of a special nature, much of it is of a general character.

A large number of orders for portions of certain machines are being received by the Standard Machinery Company at Auburn and the parts are being turned out as rapidly as possible. Some of the parts are bearings for some kind of machines to go to Canada. Manager Murphy stated that he understood the parts were for some kind of ordnance work, but he did not know just what. This work is being done as a sub-contract for a large American firm.

During the last month several of the manufacturing jewelry concerns have held meetings of their creditors because of financial difficulties. In nearly half a century the manufacturing jewelers of this city have not experienced so stringent a time as at present. In 1893, while the manufacturers suffered severe losses through failures, it was the jobbers who were in straightened circumstances, while now it is the manufacturers themselves that are being driven to the wall. The largest of these concerns was the Warren & Williams Company, whose liabilities were approximately $100,000 and assets of about $15,000. This concern has gone into bankruptcy and Horace M. Peck, appointed as receiver.

Charles J. Spooner, whose foundry is at Greenwood in Hillsgrove, reports a very satisfactory business on brass, bronze and aluminum work. He is making a feature of special mixings.

The Providence Cornice Company, makers of fireproof doors and windows, are preparing to occupy the first floor of the building at 309 Canal street in connection with its present plant. The addition will about double its plant.

The Joseph E. Miller Company, manufacturers of specialties in wire, has removed from 185 Eddy street to 39 Charles street.

The B. & G. Sheet Metal Company has removed from 112 Dorrance street to 948 Westminster street.—W. H. M.

NEW YORK, N. Y.

DECEMBER 7, 1914.

William T. Finkel, of 100 William street, states that the emery trade from Greece and Turkey is very much upset on account of the war. Rouges from Germany cannot be obtained at all, although some have come in from England. It depends upon the machinery used in a plant as to the kind or color of rouge wanted. Mr. Finkel states he has introduced black rouge in Pittsburgh and it is wanted a great deal on the Pacific Coast, but the red is more in demand in the eastern states.

R. F. Lang, of 8 Bridge street, has the sole agency in this country for the Royal nickel salts made by the United Electro Chemical Works of Germany. Other lines he is featuring that this concern makes are Zeus nickel salts, barrel plate for the mechanical plating barrel, "Argenta" for a fine silver plate, "Optic" for optical goods, double brass salts and double copper salts.

The Gorham Company had an exhibit at their Fifth avenue warerooms of a bronze tablet given to the steamship "Nieuw Amsterdam" by the grateful passengers who were safely brought here from Europe.—H. S.

NEWARK, N. J.

December 7, 1914.

Bossi Brothers have started a brass foundry at Montgomery street.

H. W. Matalene, of 153 Summit street, manufacturer of watches, has installed a plating plant.

George Freeman, who formerly manufactured electric specialties in New York City, has started the Wayne Manufacturing Company at 354 Mulberry street, Newark, and has bought the die press equipment of the Euell-Smith Company. This firm will make sheet steel household articles, die press work, and sales offices will be opened in New York City and Chicago. They will put in a nickel plating plant.

Charles F. Doher, who conducts a plating supply business at 411 Eighth avenue, New York City, has opened a branch in Newark at 530 Broad street, under the name of Charles A. Doher.—H. S.

LOUISVILLE, KY.

DECEMBER 7, 1914.

Brass and copper work in Louisville and the surrounding section of the country has been quieter during October and November, according to a number of the local concerns, than for any two fall months since 1907. Generally the condition is charged to the lack of activity of the distillers whose agreement to curtail the 1914-1915 crop of whisky is having the effect of postponing resumption of operations until the first of the year. Very few of the distillers have had any repair work done so far. Canning operations have practically been finished for the season in this part of the country, though inquiries in fairly large numbers are being received from sections of the South regarding installations which it is hoped can be finished in time for operation next season. Sheet brass and sheet copper work also has been slow for the last several weeks and there has been little

under way calling for brass rod work. The trade locally, however, is optimistic about the immediate future and expects that numbers of jobs which have been put off as long as possible will become imperative in December, while prospects are for restoration of conditions very nearly or better than normal by the first of the year.

W. P. Davis, the leading metal broker of this district, has been almost constantly in Georgia, Alabama and other Southern cities during the past few weeks. He is expected back in Louisville about December 10, and will probably remain at home until after the holidays. His office reports two raises of ½-cent each during the last week in November, after which sheet copper sold for 17½ cents per pound. The demand for sheet copper has been light, though some demand has been experienced for brass rods.

It is truly remarkable the way in which the demand has increased for copper-trimmed store fronts of the Kawneer pattern. Practically every store which has been remodeled or built in Louisville inside of the past two years has used this design. W. B. Pell & Brother, painters and glaziers, of Louisville, have done a good deal of this kind of work and have just completed a very handsome job for the Spencer Hat Company.

C. J. Thoben, of the Vendome Copper & Brass Works, reports that the concern has been very busy in the far South, but that very little Kentucky business has been handled for some time past. His partner, Elmore Sherman, has been almost constantly in the South for some months. A new whisky plant contract has just been awarded to this concern in Louisiana, where the concern recently completed another plant.

L. C. Stege, treasurer of the E. A. Stege Manufacturing Company, reports excellent business in the brass foundry, which is making castings for brewers' and distillers' machinery. This machinery is mostly used in the bottling departments. Plating has also been fairly active, but should be better.

The Kentucky Traction & Terminal Company, of Lexington, Ky., has come into the field for metal disks, which are sold six for 25 cents, in place of paper-car tickets, which were formerly used. The disks are wrapped at the company's office and bear its name on the envelopes.—J. D. C., Jr.

BUFFALO, N. Y.

DECEMBER 7, 1914.

November has been a very promising month for the local metal concerns. The long wait for the fulfilment of the prophecy that there would soon be a return of good times is beginning to come true. And one of the odd things in the present trade conditions is the fact that the price of the raw material is boosting the prices of the finished product while in the past the conditions were always the reverse.

Political conditions have something to do with the present trend of affairs, according to a number of local men. A change was long hoped for, as these men remarked, and they further added that the great change that has taken place will act as a stimulus to future trade conditions locally.

Local metal concerns are all working to some extent in co-operation with the Buffalo Chamber of Commerce in making a thorough study of the South American situation. While all of the local concerns are expected to go after this trade, a number of the larger ones are making arrangements to have a finger in the pie. Thus far the Chamber of Commerce has got out a circular giving specific instructions to local concerns as to how to handle the situation at this stage of the game, such as how to get up catalogs, how to pack articles, ship and market them, etc. But what will be the result of this cannot be said at this moment, as it is still experimental.

Not only has this present European war opened up a South American field for goods "Made in the U. S. A.," but it has also increased our market in the European countries. A number of local concerns are handling foreign orders and especially from England. And among the interesting things about this trade is the stand which some of the English metal dealers are taking as a result of this war. They are having their motto printed on their letterheads in bold red letters, which reads as follows:

"OUR MOTTO FOREVER."

"We handle every nations products except those } made in
"Nous traitous tous les products excepté ceux } Germany."

The foundries which were but merely crawling along for some months are now beginning to walk. One foundryman said: "I was out of town yesterday and every place I stopped I got an order which was six fair-sized orders in one day."

Schnell Bronze Bearing Company, Inc., is kept quite busy making bronze tablets for the municipalities of Tonawanda, Buffalo and Sloan, while the Unique Brass Foundry has just received an order for all the yellow brass work on 600 Pierce-Arrow motor trucks, and the Lumen Bearing Company landed all the manganese bronze work.

In the finishing and rolling end of the business a decided turn has also taken place. One firm alone, the Deck Bros., have obtained an order which will keep them busy for the next three months, while the Buffalo Copper and Brass Rolling Mill is doing considerable more business than they have in some time past. And according to what the various heads say they expect a bright future.

Electroplaters are not suffering for the want of work, all manage to keep busy and optimism prevails among them just as much so as in any of the other branches of the metal industry. And a very encouraging thing to electroplaters is the fact that some of the Niagara Falls chemical plants have decided to manufacture those chemicals which were heretofore produced practically exclusively in Europe.

One Gerard O. Curtiss, of 376 Massachusetts avenue, of this city, has discovered a process to nickel plate aluminum castings. Not only does he claim to nickel plate the casting, but also to give it a copper finish, red to black, or antique; gunmetal finish, polished or unpolished, oxidized or Flemish. His process he claims has been tested by a number of large and prominent concerns in this country who all claim it to be a wonderful thing. Not only does he plating, but also the casting of the article which any customer should want to the exact formula given.

He also makes reflectors which have very decided improvements. To all of his operations he says: "I will guarantee every piece of work put out by me."

At an annual meeting of the stockholders of the Buffalo Smelting Works the following new directors were elected for the coming year: Quincy A. Shaw, Boston, Mass.; Rodolphe L. Agassiz, Hamilton, Mass.; George A. Flagg, Boston, Mass.; Albert E. Jones, Buffalo, N. Y., and George M. Kendall, of Buffalo, N. Y.

Two new corporations were organized during the past month, namely: The Standard Chandelier Mfg. Company, Inc., capitalized at $5,000, to buy, sell, manufacture and design lighting fixtures, bronzes and ornamental metals. The incorporators are: John A. Fischer, Charles M. Brenneman, Fred N. Moffat, Louis A. Fischer and Charles L. Bullymore, all of Buffalo.

The other new corporation being the Dicks Metal Tube Ladder Company, Inc., capitalized at $15,000, to make metal ladders and metal goods. Incorporators are: George I. Onions, Gottfried Adophson, of Buffalo, and William Dicks, of Kenmore, N. Y.—G. W. G.

TORONTO, ONTARIO, CANADA

DECEMBER 7, 1914.

As a result of the war and new opportunities opened the mineral wealth will be developed more than ever before. Owing to the restrictions in supply, various metals have made rapid advances.

Arsenic is getting down low in quantity and higher in price and in Ontario are important arsenical ore-bearing belts. The gold in these belts will pay for the operating cost. Also the Ontario government grants a bonus of $10 per ton for white arsenic produced. Nova Scotia also has arsenical ores.

Although there are large stocks of spelter on hand, zinc is already advancing in price, Liege and Silesia, both important centers, now being out of business. Pyrites may be increased in value, if Spanish shipments are checked, and many other materials, such as French talc, emery, etc.

Canada is going after former German export centers and information is being gained from Sydney to Vancouver. Some new lines to be made or handled are copper tubing, galvanized wire netting, incandescent lamps, sheet copper, dry shells, etc.

R. E. Thorne Company, of Montreal and Valleyfield, op-

erate the Canadian Bronze Powder Works and will make a special effort to get some of the foreign trade. If business warrants it, the factory will be enlarged. A few years ago this concern was dependent on Europe for the raw materials, now they are mostly produced in Canada and made up at the Valleyfield plant.

The Ware Manufacturing Company, of Oakville, Ont., are working overtime making aluminum goods for Canada and the States. The greatest inquiry is from Quebec, due to the non use of German goods. They use British sheet aluminum exclusively.—H. S.

COLUMBUS, OHIO

DECEMBER 7, 1914.

The metal market in Columbus and central Ohio is better in every way. It is apparently recovering from the depression occasioned by the general European war and prices have advanced slightly. The best feature, however, is the better tone and brighter prospects for the future. Many of the jobbers are increasing their stocks to a large degree to be ready for the rush of orders which is expected.

It is still too early to say just what lines will be stimulated by the receipt of foreign orders, but this is expected to help the metals in a large degree. As the United States is about the only metal producing country able to make shipments the business will undoubtedly come here. Some slight increase in business in South America is experienced and certain dealers are making preparations for trade expansion in that direction.

The defeat of Governor Cox in Ohio is expected to clarify the business conditions, although the effects of the national administration is still complained of among metal men generally.

Copper is in better shape and there is a better feeling in the trade. The same is true of brass. Copper scraps are being bought for 11 to 11¼ cents, while red brass scraps are quoted at 9½ to 9¾ cents. Yellow brass is sold at 7 to 7¼ cents. Aluminum is unchanged. Babbitt is moving better and prices are steadier.

Plans and specifications have been prepared for a large addition to the plant of the Nolte Brass Foundry on West Jefferson street, Springfield, Ohio. The addition will be of concrete.—J. W. L.

CINCINNATI, OHIO

DECEMBER 7, 1914.

While still in the middle of the business depression growing out of the war, Cincinnati manufacturers in every line are making every possible preparation to take advantage of the open markets, in this country as well as abroad, left by the fact that Europe has quit work and gone to fighting. The city has been hard hit by the hostilities abroad, without question, its numerous manufacturers, all of whom have large business with Europe in normal times, finding themselves cut off from this business without warning. This is particularly true of the machine tool manufacturers whose operations make Cincinnati the leading city of the world in this line; and these manufacturers are among the largest users of metals of all sorts in the city. Without exception, they have been forced to operate on very short time since the war began, as the warring nations are their best customers outside of this country, and are now buying practically nothing. These and other manufacturers, however, are looking to South America and other markets for their goods to bring things up to a normal mark, and intend to use every effort to win those markets.

The interest felt in the possibilities in this direction was well indicated by the large attendance at a recent luncheon at which Dr. E. E. Pratt, head of the Federal Bureau of Foreign and Domestic Commerce, was the principal speaker. He outlined the methods which must be used in seeking foreign business, emphasizing the fact that the same care and foresight which are exercised in opening up a new domestic field will yield good results abroad. A branch of the bureau will be established in Cincinnati in connection with the existing foreign trade department of the Chamber of Commerce, and this will give Cincinnati manufacturers an opportunity for close touch with the situation which they will not be slow to grasp.

Numerous orders for goods in various lines, destined for the hostile nations, have been received by manufacturers in and around Cincinnati, but, unfortunately, few or none have been of any direct benefit to the metal trades. Blankets, uniforms, harness, saddlery, and automobiles are among the most active lines, while thousands of horses are being purchased. The metals are used principally in machinery and by manufacturing establishments, however, and the war has found little use for them, apparently. In consequence, business is improving only slowly with the metal trades, the machine-tool industry reporting some increase in activity, but not much.

A fire in the brass foundry of the Haven Malleable Castings Company, of Cincinnati, which manufactures saddlery hardware, practically destroyed the foundry, and badly damaged the tin department. The plant as a whole covers about two acres of ground, and is one of the largest of its kind in the country. The brass foundry was housed in a building 50 by 100 feet. The fire spread to the wood-working section of the plant, and was with great difficulty brought under control. The company had been operating actively in connection with business brought by the war. The loss caused by the fire was considerable, but is covered by insurance.

The C. C. Fouts Company, recently incorporated at Middletown, O., with a capital stock of $75,000, will handle metal products, and will probably equip a foundry in that town. The organizers of the company include C. C. Fouts, Paul Fouts, C. B. Oglesvy, P. H. Rogers and A. A. Ambler.—K. C. C.

DETROIT, MICH.

DECEMBER 7, 1914.

The last week has been one of unusual quiet in the brass and aluminum industry. This condition is largely due to the prevailing European war and also to the season. No blame is cast on the present national administration; in fact, this phase of business has been lost as the result of the stupendous economic handicap prevailing across the Atlantic. Notwithstanding the present depression, manufacturers in all lines of the metal industry express confidence in the future and believed that a change for the better is due in the early spring, even if the war still prevails at that time. Three or four of the large automobile plants, such as the Packard, Cadillac and the Federal Motor Truck companies, are closing contracts for a large number of machines for the European belligerents. This has largely stimulated the automobile industry in the line of heavy trucks. As these machines carry considerable brass and aluminum, some of the accessory plants are hoping for a revival of business in that line which now is extremely dull.

The present month marks the close of Henry Ford's profit-sharing plan for one year. The venture has proven successful beyond expectation. No man is admitted into this plan who is not willing to live a more elevated life, especially in the home. The Ford plant has thousands of men drawing five and six dollars a day and who also are investing their money in homes. The scheme has increased efficiency in every department of the great plant, and especially in the brass and aluminum branch.

Manufacturers of plumbers' supplies report an extremely quiet period and anticipate no great improvement until late in the winter. While these plants are operating, it is on a greatly reduced scale. Retailers in plumbers' supplies are expecting several large contracts later in the season, when the city begins work on eight new schools, the structures to cost in the neighborhood of $2,000,000. It is planning to begin work at once in order to give employment to needy workmen. Work already has begun on the new Carnegie library, a structure that will cost $1,000,000 or over. The schools and library will require a large quantity of plumbers' supplies of the latest design. At the present time Detroit is said to be in the best condition financially and from a labor standpoint of any other city in the country. It is, however, oversupplied with mechanics and laborers who have crowded into the city within the last few months. Manufacturers are giving preference to Detroit residents and it is not an easy matter for men outside the city to find employment here.—F. J. H.

NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

The erection of a five-story factory, as reported, by the Justrite Manufacturing Company at Southport and Hawthorn avenues, Chicago, Ill., will not be started until late next summer.

The Beecher-Fowler Manufacturing Company, 140 South Third street, Louisville, Ky., is in the market for a milling machine, lathe and power saw. This company operates a brass foundry.

The Enterprise Brass Works, Muskegon, Mich., will not erect a plant, as has been reported, but a local factory may be purchased instead. This company is equipped with a brass foundry, brass machine shop and a plating and polishing department.

The Standard Foundry Company, Hartford, Conn., are contemplating the manufacture of plumbers' supplies in the form of brass castings. They state that they are just getting ready to start their machine shop and also a plating and polishing department.

The West Bend Aluminum Company, West Bend, Wis., is now in its new day-light factory which is 260 feet long and made of steel and concrete. The sales department, general offices and sample rooms will be located on the second floor. All machinery is operated by individual motor drive.

The Standard Galvanizing & Manufacturing Company, operating a galvanizing department, 726 Canal Road, Cleveland, Ohio, plans to place on the market a line of galvanized nails and tacks. They have already purchased twenty tack machines, but from time to time will add more machines.

The American Chain Company, Bridgeport, Conn., is about to begin the erection of three buildings, 35 x 70 feet, 50 x 80 feet and 52 x 132 feet, and which will be of brick and steel construction. Plating, polishing, lacquering, japanning, stamping and galvanizing departments are among those operated.

The Crescent Brass Works, Reading, Pa., has taken out a permit for the erection of a one-story aluminum foundry on property on the northeast corner of Seventh and Bingaman streets. The building will be 24 by 24 feet and at an estimated cost of $500. This concern also has a brass foundry and brass machine shop in operation.

The Aerial Cutlery Company, Marinette, Wis., manufacturers of cutlery, etc., have been working overtime since the 15th of September and have been adding both equipment and help ever since to take care of orders that have been gradually increasing and the company states that by January they hope to double their present output.

The J. Sklar Manufacturing Company, 133 Floyd street, Brooklyn, N. Y., manufacturer of surgical instruments, is erecting a four-story brick factory, 66 x 113 feet, and which is to cost $35,000. This concern employs, in connection with their business, a plating and polishing department, a brass machine shop and a spinning and stamping department.

The Electrical Alloy Company, manufacturers of resistance materials, Morristown, N. J., announce that they are now manufacturing a resistance wire called Calido that has a resistance of one hundred and sixty-three ohms to the foot, and this wire is made one and one-half thousandths of an inch in diameter and is accurate to within two per cent. of a predetermined value.

The plant operated by the Johnson Electric Smelting, Incorporated, controlling the American zinc rights of the Continuous Zinc Furnace Company, Hartford, Conn., has been moved to Keokuk, Iowa, where a new plant is to be erected to prove the commercial value, if possible, of the Johnson electrothermic process for the smelting of zinc-bearing lead and copper ores.

It is reported that the Southern Aluminum Company has found it difficult, owing to the war, to obtain funds, so has discontinued its construction work. The work was well along; the power house was nearly up; the electrode factory was nearly completed; 35,000 cubic yards or more of concrete has been laid on the big dam and work had begun on the purifying plant.

It is stated by the Westinghouse Lamp Company, of New York, N. Y., that the Milwaukee, Wis., plant of this concern is not in complete operation, as was stated in a published report. The company also states that the capacity of this plant will be 600,000 lamps when it is in complete operation, but that they cannot say definitely when the maximum production will be secured.

The General Platers' Supply Company, 509 West 45th street, New York, announce that since the business was established last May they have made excellent progress in spite of the general business depression and that they are now in a better position than ever to fill orders for all kinds of plating and polishing supplies. H. F. Arthur is president of the company and H. J. Osborne is secretary and treasurer.

Charles F. L'Hommedieu & Sons Company, manufacturers of polishing lathes, plating dynamos, polishing wheels, etc., have recently gone into the manufacture of buffing compositions. They are now ready to place on the market their full line of compositions to meet the various requirements of the trade and are equipped to give prompt and efficient service. They invite correspondence, as they are manufacturing some special compositions.

A five-day-a-week shift has been started at the Baldwin Locomotive Works, Philadelphia, Pa., as the result of a $1,500,000 order, obtained from Russia, by Samuel M. Vauclain, vice-president of the company. The order comprises 30 locomotives, 200 machine tools and other work the nature of which was withheld from public announcement. The shipment, which will be by way of Vladivostock, Siberia, direct from Philadelphia and New York, must be ready in two months.

The Universal Polishing & Plating Company, located at 355 Trumbull street, Hartford, Conn., has been organized by J. J. and F. Ahern, M. P. Marks and Richard J. Marks. They have purchased the equipment of the Pope Manufacturing Company's polishing and plating plant of that city and they are prepared to do polishing, plating, buffing and refinishing of metals at reasonable prices, as they claim to have one of the best equipped plants in New England.

For the past fifteen years the Perry-Austen Manufacturing Company, Grasmere, Staten Island, New York City, has been manufacturing lacquers of all types, and number among their customers the largest corporations and manufacturing concerns in the United States. They announce that in view of the fact that their position is a very favorable one on raw materials, they are making particular drives on their Whites and Blacks, and their contracts for 1915 on this basis are considerably larger than ever.

The Stamford Silver Company, Stamford, Conn., has been reorganized and incorporated under the name of the United German Silver Company. The purpose of the concern is to make and deal in brass, copper and silver. The incorporators are William F. Finney, president; J. G. MacKay, secretary, and W. F. Cressy, treasurer. The capital stock is $100,000 and is divided into 2,000 shares. The affairs of the old company were so adjusted, it is reported, that the stockholders received fifteen cents on the dollar, or stock in the new concern equal to that amount.

The Cleveland Metal Products Company is adding to their steel stamping and porcelain enameling plant extensive buildings and equipment for the casting, rolling and fabrication of aluminum. Their present enameling plant is 160 feet x 252 feet. In addition to this they have a factory building 62 feet x 170 feet, which is five stories high. An addition, 266 feet long and 10 feet wider, is being made to this building, the extension to be used in the manufacture of aluminum cooking utensils. A casting building 57 feet x 82 feet and a rolling mill building 82 feet x 190 feet are under construction to provide sheets and castings for utensils. Aluminum sheets and castings will also be sold other manufacturers.

The Lamberson Japanning Company, japanners, enamelers, etc., 334-338 South Clinton street, Chicago, Ill., announce that they are prepared to apply to metal parts a fine, durable imitation mahogany finish that is in keeping with high-class wooden furniture and other wooden articles of the finest kind. It is stated that the richness, quality and tone of this finish has never been equaled. Also, they specialize on imitation oak, circassian walnut, as well as an enamel finish that is an imitation of the platers' oxidized copper. They will continue as heretofore to apply high-grade baked finishes in the blacks, whites, bronzes and colors.

SALE OF GOVERNMENT MATERIAL

There will be sold at the Navy Yard, Portsmouth, N. H., material belonging to the Navy, condemned as unfit for use therein, consisting of whaleboats, steam cutters, metallic life-boats, launches, furniture, rugs, books, table linen, dishes, hose, canvas cuttings, manila and hemp junk, burned out lamps, surrey, hand tools, machine tools, steel plate fans, engines, motors, pumps, locomotive cranes, hydraulic keel bender, zinc dress, iron pipe, scrap iron and steel, etc. The sale will be for cash to the highest bidder, by sealed proposals to be opened at 10 a. m. December 17, 1914. Schedules containing form of proposals and terms of sale can be obtained upon application to the General Storekeeper, Navy Yard, Portsmouth, N. H.

JOSEPHUS DANIELS,
Secretary of the Navy.

THE BUREAU OF STANDARDS CIRCULAR ON ELECTROTYPING BATHS

At the meeting in New York on October 7, 1914, the International Association of Electrotypers appointed a committee to co-operate with the Bureau of Standards in a study of the conditions used in copper and nickel electrotyping, with a view toward placing the industry on a more scientific basis. The first work to be carried out in this direction will be to gain information regarding the actual conditions in use and the nature and importance of the problems involved. Arrangements have therefore been made to test solutions, etc., at regular intervals from a few typical establishments, in order to learn not only the composition of the solutions, but also the charges taking place in them, and the efficiency of the present methods of regulation. In addition a limited number of such samples as may be sent in from other electrotypers will be analyzed free; the amount of such work being restricted by the limited force now available for this work. In general such work is done only for the purpose of investigation and in no sense in competition with commercial chemists. In connection with such tests, whatever information and advice is available will be furnished, but of course there is no assurance of being able to remedy all existing defects; since the services of a number of men for a considerable period will be required for an exhaustive study of this subject.

In the meantime all inquiries regarding specific difficulties in the work will be answered so far as possible. To meet the immediate requests for such information, a preliminary circular on the "Testing of Electrotyping Solutions" has been prepared, in which are given simple directions for testing and adjusting the density and acidity of acid copper sulphate electrotyping solutions. This circular will be enlarged and revised at intervals as the work progresses. Copies of this circular will be sent upon request to the Bureau of Standards, Washington, D. C.

REMOVAL

The Chicago Aluminum Castings Company, Chicago, Ill., are now located at 2647-51 Ogden avenue, where they have built a modern foundry to take care of the increased demand for their aluminum castings.

CHANGE IN FIRM NAME

The firm name of the Rosedale Brass Manufacturing Company, 1801 First avenue, New York City, has been changed to the Victor Brass Works.

The name of the concern known as the American Safety Appliance Company has been changed to the Milwaukee Die Casting Company, Milwaukee, Wis.

Hegeler Brothers, a partnership, has been reorganized into a new corporation known as the Hegeler Zinc Company, Danville, Ill. The business will be continued under the same management and with the same policies.

BUSINESS TROUBLES

A final meeting of the creditors of the F. J. Lederer Company, Buffalo, N. Y., was held in that city on November 18, 1914.

The Electrolytic Art Metal Company, Trenton, N. J., is reported by its counsel, F. R. Brace, to be in financial difficulties and the directors have formulated three possible courses which may be followed for the winding up of the business. Three propositions have been offered to the creditors by the directors, which are as follows: (1) To permit of the deliberate liquidation of the assets which will, it is expected, produce fifteen cents on the dollar; (2) to purchase at ten cents on the dollar claims of such creditors who do not care to wait for the liquidation; (3) a receivership.

It is stated by the counsel that the directors feel that if the receivership is adopted there will be nothing left for the creditors, so acceptance of either the first or second is strongly urged.

INCORPORATIONS

Business organizations incorporated recently. In addressing them it is advisable to include also the names of the incorporators and their residence. Particulars of additional incorporations may frequently be found in the "Trade News" columns.

To manufacture metal products of all kinds.—The C. C. Fouts Company, Middletown, Ohio. Capital $75,000. C. C. Fouts, C. B. Oslesby, Paul Fouts, P. H. Rogers and A. A. Ambler.

To operate a brass foundry.—The Canton Brass Foundry Company, Canton, Ohio. Capital $20.000. Incorporators: Francis D. Held and others. This company has been incorporated to succeed the Canton Brass Works.

To do general plating.—The Randall-Philpott Plating Company, Cleveland, Ohio. Capital $10,000. Incorporators: George H. Randall, Edward D. Philpott, D. V. Fisher, John D. Fackler and David J. Dye.

To manufacture hardware, etc.—Spooner Campbell Company, Gouverneur, N. Y. Capital $40,000. Incorporators: A. F. Spooner, Richville, N. Y.; J. W. Henderson, E. W. Campbell and V. S. Campbell, Gouverneur, N. Y.

To deal in metal goods etc.—William Vogel & Brothers, Inc., Brooklyn, N. Y. Capital $100,000. Incorporators: Louis H. Vogel, William H. Vogel and Harry M. Edwards. Departments for stamping, plating, polishing, lacquering and japanning are operated by this firm.

To do metal spinning and stamping of all descriptions.—The Universal Metal Spinning and Stamping Company, New York, N. Y. Capital $9,000. Incorporators: Simon and Lena Tepper, Yetta Ruskin. This concern was formerly known as the Universal Metal Spinning Company.

FOREIGN TRADE OPPORTUNITIES

For addresses of these enquirers apply to Bureau of Foreign and Domestic Commerce, Washington, D. C., and give file number.

No. 14,621. Raw aluminum.—A firm in Great Britain desires to correspond with American makers of raw aluminum who can make aluminum ingots 98 to 99 per cent. pure.

No. 14,623. Metal pipes and fittings.—A consul reports that a firm in Europe wishes to correspond with American manufacturers of water, steam and boiler pipes; also galvanized, brass and copper pipes. Correspondence may be in English.

No. 14,353. Art metal work.—A firm in South America advises an American consul that it desires to receive the names of American manufacturers of art metal work, metal corners, cornices and ceilings. Correspondence should be in Spanish.

No. 14,528. Brass pipe.—A firm dealing in electric machinery and supplies is desirous of purchasing brass pipe, which it is stated the firm uses in large quantities. Prior to the disturbed commercial conditions the firm procured its supplies abroad.

No. 14,610. Zinc sheets and rolled zinc.—A consul reports that a firm in the United Kingdom has requested names and addresses of American manufacturers of zinc sheets and rolled zinc. They state that they are large buyers of sheet zinc in barrels.

No. 14,643. Brass rods.—A company in the United Kingdom is desirous of communicating with American producers of brass rods in small sizes, round and hexagon shape, up to 9/16 inch maximum with special drawn section. Abroad these rods are known as "Delta."

No. 14,400. Foundry metals.—An Italian agent informs an American consular officer that he desires to represent, as agent, American manufacturers of foundry metals, such as copper, zinc, lead, tin, iron and manganese iron. It is explained that this agent is familiar with this line of business, having represented English and German firms. References are furnished. Correspondence should be in Italian or French.

No. 14,368. Zinc sheets.—A firm in the United Kingdom advises an American consular officer that it uses large quantities of zinc sheets in 19, 20 and 22 gauge of best quality for spinning purposes. American manufacturers of this commodity are invited to quote prices, etc., stating when delivery could be made. Delivery should be c. i. f. destination. It is explained that the quality must be first class. The firm has been using a brand known as "V. M."

INQUIRIES AND OPPORTUNITIES

Under our directory of "Trade Wants" (published each month in the rear advertising pages), will be found a number of inquiries and opportunities which, if followed up, are a means of securing business. Our "Trade Want Directory" fills wants of all kinds, assists in the buying and selling of metals, machinery, foundry and platers' supplies, procures positions and secures capable assistants. See Want Ad. pages.

PRINTED MATTER

Lathes.—The Hanson & Van Winkle Company, Newark, N. J., have issued bulletin No. 126, giving complete description and illustration of their new ball bearing polishing and buffing lathe. These lathes are furnished in two sizes, No. 5-BB for heavy and No. 10-BB for light work.

Platers' Supplies.—D. B. Moyer, manufacturers' agent, Detroit, Mich., has issued a folder containing a handsome halftone engraving of himself and a description of the various materials that he handles. Among these are included electroplaters', polishers' and buffers' supplies and equipment and he states that he is in a position to furnish material of the various best quality at the lowest prices.

Saving Fuel.—The Armstrong Cork & Insulating Company, Pittsburgh, Pa., have issued a very interesting little booklet under the above title. This booklet tells the story of Nonpareil insulating brick for boiler settings and sets forth in a very interesting manner an explanation of what the Nonpareil line of material consists of, where it comes from, how it is manufactured and what the bricks accomplish. A more complete description of these bricks are contained in an article published in THE METAL INDUSTRY for September, 1914.

Steel Balls.—The Abbott Ball Company, of Hartford, Conn., are sending out an announcement that they have perfected special machinery whereby they are able to furnish perfect balls in all sizes from ⅛ inch to ½ inch in diameter, and expect later to be in a position to furnish all other sizes. They also state regarding bearing balls that they have, by means of the special Abbott stock used and mode of manufacture, been able to overcome the common trouble of fire-cracked balls and that they are absolutely sure that they will never get any such material.

Aluminum.—The British Aluminum Company, Ltd., London, England, have issued a series of their loose leaf catalogs relating to their aluminum products. The collection of catalogs is enclosed in a handsome cloth binder which has space for a great many more sections of the catalog which may be added from time to time. The sections already issued include descriptions of an information relating to the erection and jointing of aluminum overhead conductors; physical, mechanical and electrical properties of aluminum, and aluminum in the service of electric traction and power transmission.

Metal Working Machinery.—The E. W. Bliss Company Brooklyn, N. Y., have isued the fourteenth edition of their general catalog of presses, dies, punches, shears, slitters, trimmers, double-seaming machines, spinning lathes and special machines for working sheet-metal, drop-forging equipments and automatic tin-can machinery. This book, which is bound in cloth, is 6½x9½ inches in size; contains 840 pages and is fully illustrated, is more like a metal working encyclopedia than a trade catalog, and it certainly reflects great credit on the Bliss company for the excellent manner in which the subject matter contained in it has been prepared. It will make a valuable addition to the library of any manufacturer of metal goods no matter how they may be produced, that is, by stamping, drawing or spinning.

Precious Metals.—Handy & Harman, Bridgeport, Conn., smelters and refiners of gold, silver and platinum, are now distributing to manufacturing jewelers and silversmiths a little forty page book bound in cloth, which they call "The Handy Book." The Handy Book is published by the service department of Handy & Harmon, and the object of the work is to provide the progressive manufacturing jeweler with information that will be of value to him in the manufacture of his product. The book, as stated before, contains forty pages, and is filled with descriptions and illustrations of the various gauges used in the jewelry trade and a good deal of information relating to karat gold, including formulas for the manufacture of various karat golds, how to raise and reduce the fineness of gold, and also how to recover gold and silver from cyanide solutions. There are also given a list of weight tables of gold, silver and platinum. Taking it altogether the book should prove a very valuable aid to any metal worker. Handy & Harman desire to present a copy of this book to every manufacturing jeweler and silversmith in the United States and Canada, while a charge of fifty cents will be made for additional copies.

CATALOG EXHIBIT

An exhibition of every kind of catalog may be seen at The Metal Industry office, 99 John street, New York. The Metal Industry is prepared to do all of the work necessary for the making of catalogs, pamphlets, circulars and other printed matter. Estimates will be furnished for writing descriptions, making engravings, printing, binding, for the entire job from beginning to end or any part of it.

METAL MARKET REVIEW

NEW YORK, December 7, 1914.

COPPER.

From 11¼ cents for Electrolytic at the beginning of November prices were run up to 12¾ early in December, and some producers reported business at ⅛ higher. Consumers came into the market very freely and the more the prices were pushed up the more consumers seemed to like it. The export demand was reported active, the Wall Street news ticker was used with telling effect to boost prices and scare the consumers, the consumers took it all for gospel and copper metal from being a drug in the market seemed to become actually scarce, hardly seemed enough to go around, etc., etc. It was all very cleverly managed. Some one in the trade the other day made the remark that the domestic copper consumers were "easy" and it looks like that man was right.

The export situation is not in any better shape and Germany is not going to get any copper. The exports of copper are not to be published until thirty days have elapsed so there is no knowing how much copper was exported during November. We shall probably know by the end of December and in future we shall be just one month behind or until the Copper Producers' Association publishes their monthly statement again.

The market today is in pretty good shape, producers are fairly well sold up. Lake is quotable at 13 to 13⅛ cents, Electrolytic 12¾ to 13, and Casting 12¾ cents.

TIN.

The tin market during the month has held fairly steady—for tin—opening at around 32 cents the low point, prices advanced to 34.50, the high for the month and closed at around 33½ cents. With a daily cable from the London Metal Exchange each day and a daily call on the New York Metal Exchange the tin market is just about normal and business seems to be going on as usual. The consumption for the month is estimated at 2,600 tons and this seems pretty good as against 2,800 tons for the same month a year ago.

Prices today are around 33¾ for shot tin and from 32 to 32¼ for future deliveries.

LEAD.

The lead trust has been doing things to the lead market this month and some would-be speculators have been shown how easy it is to guess wrong. Aside from the rap to speculators it has been surmised that the reason for the trust's erratic action was to keep the price of ores from getting too high. When our last report was written the trust price was 3.50 New York, November 12 price was advanced 10 points to 3.60, November 17 to 3.70 and November 19, 20 points to 3.90; that all looked very good and probably a whole lot of lead was unloaded on the innocent American consumers—most of the domestic lead consumers are Americans, but the lead trust is mostly imported material and seems to be altogether immune from any anti-trust legislation. A day or so after the price had been advanced to 3.90 or to be exact, as we always like to be, on November 28 the price was suddenly dropped 10 points to 3.80 New York basis and that is where the market is today. East St. Louis is quotable at 3.72½ trust to 3.70 independents.

SPELTER.

The market has been dull and more or less soft during the early part of the month, later there were several inquiries from abroad and the market has become steadier—also there are signs that the home consumption is improving and the spelter market generally looks good for higher prices. Prices are around 5.70 to 5.75 New York and 5.50 to 5.55 East St. Louis. Sheet zinc has been advanced to 8¼ at mill.

ALUMINUM.

There is very little to be said about aluminum, market has been very quiet, but is firmer at the close and prices show an advance of nearly ½-cent per pound. Ingots 98 to 99 per cent. are quoted at 18¾ to 19¼.

ANTIMONY.

The antimony market has been quite active on inquiries from Europe and more or less speculative buying in America. Prices today are about the same as a month ago, Cooksons 16½ to 16¾ cents, Hallets 15 to 15½ and Hungarian grade 13¼ to 13¾ cents.

SILVER.

The silver market after opening at around 48½ cents advanced to 49⅞ and closed at 49½ cents with London at 22⅞*d*.

PLATINUM.

Market has been very quiet, consumers have not been buying and prices are about $4 per ounce lower. Ordinary refined is quoted around $42, with 10 per cent. hard at $48 per ounce.

QUICKSILVER.

Market has been dull and easier and prices today are about $5 per flask lower than a month ago. Wholesale lots $52.50 with smaller lots $3 to $4 higher.

SHEET METALS.

All copper and brass products have been advanced in accordance with the higher copper market. Sheet copper has been advanced to 18 cents base, copper wire 14 to 14¼ cents and high sheet brass to 13¼ cents.

OLD METALS.

The rapid advance in copper and lead during the month brought in buyers for all kinds of copper scrap and the market has been fairly active and some good business was done with consumers. At the close the market is quiet with all prices higher than a month ago.—J. J. A.

NOVEMBER MOVEMENTS IN METALS

	Highest.	Lowest.	Average.
COPPER:			
Lake	12.83	11.35	12.15
Electrolytic	12.65	11.15	11.75
Casting	12.50	11.00	11.65
TIN	34.55	32.00	33.55
LEAD	3.90	3.50	3.75
SPELTER	5.40	5.00	5.15
ANTIMONY (Hallett's)	16.50	15.50	15.85
SILVER	49⅞	47⅝	49.10

WATERBURY AVERAGE

The average price of Lake Copper per pound as determined monthly at Waterbury, Conn.:

1912—Average for year, 16.70. 1913—Average for year, 15.83. 1914—January, 14.75; February, 15.125; March, 15.00; April, 14.875; May, 14.75; June, 14.375; July, 14.125; August, 13; September, 12.875; October, 12.25; November, 12.25.

COPPER PRODUCTION

There are no figures to be had.

DAILY METAL PRICES

We have made arrangements with the New York Metal Exchange by which we can furnish our readers with the Official Daily Market Report of the Exchange and a year's subscription to THE METAL INDUSTRY for the sum of $10. The price of the Report alone is $10. Sample copies furnished for the asking. We can furnish daily telegraphic reports of metal prices. Address THE METAL INDUSTRY, 99 John street, New York.

Metal Prices, December 7, 1914

NEW METALS.	Price per lb. Cents.
COPPER—PIG AND INGOT AND OLD COPPER. Duty Free. Manufactured 5 per centum.	
Lake, carload lots, nominal	13.25
Electrolytic, carload lots	13.00
Castings, carload lots	12.75
TIN—Duty Free.	
Straits of Malacca, carload lots	33.85
LEAD—Duty Pig, Bars and Old, 25%; pipe and sheets, 20%. Pig lead, carload lots	3.80
SPELTER—Duty 15%. Sheets, 15%.	
Western, carload lots	5.70
ALUMINUM—Duty Crude, 2c. per lb. Plates, sheets, bars and rods, 3½c. per lb.	
Small lots, f. o. b. factory	24.00
100 lb. lots, f. o. b. factory	21.00
Ton lots, f. o. b. factory	19.00
ANTIMONY—Duty free.	
Cookson's cask lots, nominal	16.75
Hallett's cask lots	15.50
Hungarian grade	13.75
NICKEL—Duty Ingot, 10%. Sheet, strip and wire 20% ad. valorem.	
Shot, Plaquettes, Ingots. Blocks according to quantity	.38 to .43
ELECTROLYTIC—3 cents per pound extra.	
MANGANESE METAL	.95
MAGNESIUM METAL.—Duty 25% ad valorem (100 lb. lots)	1.80
BISMUTH—Duty free	3.00
CADMIUM—Duty free	2.50
CHROMIUM METAL—Duty free	.75
COBALT—97% pure	2.00
QUICKSILVER—Duty 10%, per flask	$52.50-$55.00
	Price per oz.
GOLD—Duty free	$20.67
PLATINUM—Duty free	46.00
SILVER—Government assay bars—Duty free	49⅝c.

INGOT METALS	Price per lb Cents.
Silicon Copper, 10% ... according to quantity	25 to 28
Silicon Copper, 20% ... " "	28 to 32
Silicon Copper, 30% guaranteed " "	30 to 34
Phosphor Copper, guaranteed 10% "	24 to 28
Phosphor Copper, guaranteed 15% "	25 to 29
Manganese Copper, 25% ... " "	25 to 29
Phosphor Tin, guaranteed 5% " "	57 to 60
Phosphor Tin, no guarantee " "	36 to 39
Brass Ingot, Yellow ... " "	8 to 9½
Brass Ingot, Red ... " "	11 to 12
Bronze Ingot ... " "	10½ to 11¼
Manganese Bronze Ingots ... " "	17 to 18½
Phosphor Bronze ... " "	18 to 20
Casting Aluminum Alloys ... " "	16 to 18

PHOSPHORUS—Duty free.	
According to quantity	30 to 35

Dealers' Buying Prices. Cents per lb.	OLD METALS.	Dealers' Selling Prices. Cents per lb.
11.00 to 11.25	Heavy Cut Copper	12.25 to 12.50
10.50 to 10.75	Copper Wire	11.75 to 12.00
9.50 to 9.75	Light Copper	10.75 to 11.00
10.00 to 10.25	Heavy Mach. Comp.	11.00 to 11.25
7.75 to 8.00	Heavy Brass	8.75 to 9.00
5.75 to 6.00	Light Brass	6.75 to 7.00
7.50 to 7.75	No. 1 Yellow Brass Turnings	8.25 to 8.50
8.50 to 9.00	No. 1 Comp. Turnings	9.50 to 10.00
3.35 to ——	Heavy Lead	—— to 3.60
3.75 to ——	Zinc Scrap	—— to 4.00
5.50 to 6.50	Scrap Aluminum Turnings	6.00 to 7.00
11.50 to 12.00	Scrap Aluminum, cast alloyed	12.00 to 13.00
13.00 to 14.00	Scrap Aluminum, sheet (new)	13.00 to 14.00
23.00 to 24.00	No. 1 Pewter	25.00 to 26.00
17.00 to 23.00	Old Nickel	17.00 to 23.00

PRICES OF SHEET COPPER.

BASE PRICE, 18 Cents per Lb. Net.

SIZE OF SHEETS. Width.	LENGTH.	64 oz. and over.	32 oz. to 64 oz.	24 oz. up to 32 oz.	16 oz. up to 24 oz.	15 oz.	14 oz.	13 oz.	12 oz.	11 oz.
		Extras in Cents per Pound for Sizes and Weights Other than Base.								
Not wider than 30 ins.	Not longer than 72 inches.	Base	Base	Base	Base	½	1	1½	2	2½
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	½	1	2	3	4½
	Longer than 96 inches. Not longer than 120 inches.	"	"	½	1	2	3	5	7	
	Longer than 120 ins.	"	"	1	1½					
Wider than 30 ins. but not wider than 36 inches.	Not longer than 72 inches.	"	"	Base	Base	1	2	3	4	6
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	1	2	4	6	8
	Longer than 96 inches. Not longer than 120 inches.	"	"	1	2	3	4			
	Longer than 120 inches.	"	1	2	3					
Wider than 36 ins. but not wider than 48 inches.	Not longer than 72 inches.	"	Base	1	2	3	4	6	8	9
	Longer than 72 inches. Not longer than 96 inches.	"	"	1	3	4	5	7	9	
	Longer than 96 inches. Not longer than 120 inches.	"	"	2	4	6	9			
	Longer than 120 inches.	"	1	3	6					
Wider than 48 ins. but not wider than 60 inches.	Not longer than 72 inches.	"	Base	1	3	5	7	9	11	
	Longer than 72 inches. Not longer than 96 inches.	"	"	2	4	7	10			
	Longer than 96 inches. Not longer than 120 inches.	"	1	3	6					
	Longer than 120 inches.	1	2	4	8					
Wider than 60 ins. but not wider than 72 ins.	Not longer than 96 inches.	Base	1	3	8					
	Longer than 96 inches. Not longer than 120 inches.	"	2	5	10					
	Longer than 120 inches.	1	3	8						
Wider than 72 ins. but not wider than 108 ins.	Not longer than 96 inches.	1	3	6						
	Longer than 96 inches. Not longer than 120 inches.	2	4	7						
	Longer than 120 inches.	3	5	9						
Wider than 108 ins., but not wider than 120 ins.	Not longer than 120 inches.	4	6							

The longest dimension in any sheet shall be considered at its length.

CIRCLES, 8 IN. DIAMETER AND LARGER, SEGMENTS AND PATTERN SHEETS, advance per pound over prices of Sheet Copper required to cut them from ..... 3c.

CIRCLES LESS THAN 8 IN. DIAMETER, advance per pound over prices of Sheet Copper required to cut them from ..... 5c.

COLD OR HARD ROLLED COPPER, 14 oz. per square foot and heavier, advance per pound over foregoing prices ..... 1c.

COLD OR HARD ROLLED COPPER, lighter than 14 oz. per square foot, advance per pound over foregoing prices ..... 2c.

COLD ROLLED ANNEALED COPPER, the same price as Cold Rolled Copper.

ALL POLISHED COPPER, 20 in. wide and under, advance per square foot over the price of Cold Rolled Copper ..... 1c.

ALL POLISHED COPPER, over 20 in. wide, advance per square foot over the price of Cold Rolled Copper ..... 2c.

For Polishing both sides, double the above price.

The Polishing extra for Circles and Segments to be charged on the full size of the sheet from which they are cut.

COLD ROLLER COPPER, prepared suitable for polishing, same prices and extras as Polished Copper.

ALL PLANISHED COPPER, advance per square foot over the prices for Polished Copper ..... 1c.

ZINC—Duty, sheet, 15%.

	Cents per lb.
Carload lots, standard sizes and gauges, at mill	8.25 basis, less 8%
Open casks, jobbers' prices	8¾c.
Casks, jobbers' prices	9¼c.

Metal Prices, December 7, 1914

PRICES ON BRASS MATERIAL—MILL SHIPMENTS.

In effect December 1, 1914, and until further notice.

To customers who buy over 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.13¼	$0.14⅞	$0.16
Wire	.13	.14⅞	.16
Rod	.13	.15⅝	.17
Brazed tubing	.17	—	.20¼
Open seam tubing	.17	—	.20¼
Angles and channels	.17	—	.20¼

50% discount from all extras as shown in Brass Manufacturers' Price List.

NET EXTRAS FOR QUALITY.

Sheet—Extra spring, drawing and spinning brass....	½c.	per lb. net advance
" —Best spring, drawing and spinning brass....	1½c.	" " " "
Wire—Extra spring and brazing wire.....	½c.	" " " "
" —Best spring and brazing wire.....	1c.	" " " "

To customers who buy 5,000 lbs. or less per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.14½	$0.16⅛	$0.17¼
Wire	.14½	.16⅛	.17¼
Rod	.14½	.16⅞	.18¼
Brazed tubing	.18¼	—	.21½
Open seam tubing	.18¼	—	.21½
Angles and channels	.18¼	—	.21½

Net extra as shown in Brass Manufacturers' Price List.

NET EXTRAS FOR QUALITY.

Sheet—Extra spring, drawing and spinning brass....	½c.	per lb. net advance
" —Best spring, drawing and spinning brass.....	1½c.	" " " "
Wire —Extra spring and brazing wire.....	½c.	" " " "
" —Best spring and brazing wire	1c.	" " " "

BARE COPPER WIRE—CARLOAD LOTS.

14c. per lb. base.

SOLDERING COPPERS.

300 lbs. and over in one order	18½c. per lb. base
100 lbs. to 300 lbs. in one order	19c. " " "
Less than 100 lbs. in one order	20½c. " " "

PRICES FOR SEAMLESS BRASS TUBING.

From 1¼ to 3½ O. D. Nos. 4 to 13 Stubs' Gauge, 15½c. per lb.
Seamless Copper Tubing, 19½c. per lb.

For other sizes see Manufacturers' List.

PRICES FOR SEAMLESS BRASS TUBING Iron Pipe Sizes.

Iron pipe sizes with price per pound.

⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6
23½	22½	17½	16½	15½	15½	15½	15½	15½	15½	15½	16½	17½	19½	21½	22½

PRICE LIST OF IRON LINED TUBING—NOT POLISHED.

	Per 100 feet Brass.	Bronze.
⅜ inch	$8	$9
½ inch	8	9
⅝ inch	10	11
¾ inch	12	13
⅞ inch	14	15
1 inch	18	20
1¼ inch	22	24
1½ inch	25	27
1¾ inch	32	35
1¾ inch	45	48
2 inch	56	69

Discount 55-5%.

PRICE FOR TOBIN BRONZE AND MUNTZ METAL.

Tobin Bronze Red	17c.	net base
Muntz or Yellow Metal Sheathing (14" x 48")	13½c.	" "
" " " " Rectangular sheets other than Sheathing.	16c.	" "
" " " " Rod	13½c.	" "

Above are for 100 lbs. or more in one order.

PLATERS' METALS.

Platers' bar in the rough, 22½c. net.

German silver platers' bars dependent on the percentage of nickel, quantity and general character of the order.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturers.

PRICES FOR SHEET BLOCK TIN AND BRITANNIA METAL.

Sheet Block Tin—18" wide or less. No. 26 B. & S. Gauge or thicker. 100 lbs. or more 5c. over Pig Tin. 50 to 100 lbs. 6c. over, 25 to 50 lbs. 8c. over, less than 25 lbs. 10c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 4c. over Pig Tin. 50 to 100 lbs. 5c. over, 25 to 50 lbs. 7c. over, less 25 lbs. 9c. over.

Above prices f. o. b. mill.

Prices on wider or thinner metal on request.

PRICE SHEET FOR SHEET ALUMINUM—B. & S. Gauge.

Gauge.	Width. Inches.	1 ton.	500 lbs.	50 lbs.	Less than 50 lbs.
20 and heavier	3-30	30c.	34c.	36c.	38c.
21 to 24 inclusive	3-30	32c.	35c.	37c.	39c.
	30-48	33c.	37c.	39c.	41c.
	48-60	39c.	40c.	42c.	44c.
25 to 26	3-30	33c.	36c.	38c.	40c.
	30-48	35c.	38c.	40c.	42c.
27	3-30	36c.	37c.	39c.	41c.
	30-48	39c.	40c.	42c.	44c.
28	3-30	37c.	38c.	40c.	42c.
	30-48	40c.	41c.	43c.	45c.
29	3-30	38c.	39c.	41c.	43c.
	30-48	42c.	43c.	45c.	47c.
30	3-30	39c.	40c.	42c.	44c.

The above prices refer to lengths between 2 and 8 feet. Prices furnished by the manufacturers for wider and narrower sheet. No charge for boxing. F. O. B. Mill.

PRICE LIST SEAMLESS ALUMINUM TUBING.

STUBS' GAUGE THE STANDARD. SIZES CARRIED IN STOCK.
Outside Diameters. BASE PRICE, 24 Cents per Pound.

Stubs' Gauge.	Inches.	¼ in.	5-16 in.	⅜ in.	½ in.	⅝ in.	¾ in.	⅞ in.	1 in.	1¼ in.	1½ in.	1¾ in.	2 in.	2½ ins.	3 ins.	3½ ins.	4 ins.	4½ ins.
11.	.120.	..	..	..	..	..	..	..	26	23	..	..	13	19	9	8	15	22
12.	.109.	..	..	..	..	..	..	..	25	..	..	..	14	..	..	..	..	..
14.	.083.	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..
16.	.065.	..	..	..	..	..	27	26	26	23	22	20	20	20	20	26	30	36
18.	.049.	..	..	..	..	32	29	28	27	24	25	25	25	..	..	..	..	..
20.	.035.	116	..	45	38	33	32	31	29	28	29	29	29	30	37	48	57	80
21.	.032.	..	..	..	39	..	..	..	..	..	..	..	..	..	..	..	..	..
22.	.028.	137	97	47	41	37	36	34	33	..	..	44	..	..	..	..	..	..
24.	.022.	187	132	107	87	78	72	61	50	65	..	..	..	..	..	..	..	..

Prices are for ten or more pounds at one time. For prices on sizes not carried in stock send for Manufacturers' List.

PRICE LIST FOR ALUMINUM ROD AND WIRE.

Diameter. B. & S. G'ge	000 to No.	No. 10.	No. 11.	No. 12.	No. 13.	No. 14.	No. 15.	No. 16.	No. 17.	No. 18.	No. 19.	No. 20.	No. 21.	No. 22.
Price per lb....	33	33½	33½	34	34½	35	35½	36	37	38	39	44	47	

BASE PRICE GRADE "B" GERMAN SILVER SHEET METAL.

Quality.	Net per lb.	Quality.	Net per lb.
5%	18¼c.	16%	22¾c.
8%	20c.	18%	23¼c.
10%	20½c.	20%	25½c.
12%	21½c.	25%	33¾c.
15%	22½c.	30%	39¾c.

GERMAN SILVER WIRE.

Quality.	Net per lb.	Quality.	Net per lb.
5%	19¼c.	15%	26½c.
8%	21c.	16%	27½c.
10%	22½c.	18%	29¼c.
12%	24½c.	30%	45¼c.

The above Base Prices are subject to additions for extras as per lists printed in Brass Manufacturers' Price List and from such extras 50% discount will be allowed. The above base prices and discounts are named only to wholesale buyers who purchase in good quantities. Prices on small lots are considerably higher.

PRICES OF SHEET SILVER.

Rolled sterling silver .925 fine is sold according to gauge quantity and market conditions. No fixed quotations can be given, as prices range from 1c. below to 4c. above the price of bullion.

Rolled silver anodes .999 fine are quoted at 2½c. to 3½c. above the price of bullion.

THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED

THE ALUMINUM WORLD, THE BRASS FOUNDER AND FINISHER, THE ELECTRO-PLATERS REVIEW, COPPER AND BRASS

A TRADE JOURNAL RELATING TO METALS AND ALLOYS

Index of Volume 12

JANUARY—DECEMBER, 1914

THE METAL INDUSTRY PUBLISHING COMPANY, 99 John Street, New York

ARTICLES MARKED (*) ARE ILLUSTRATED.

ARTICLES

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NEW BOOKS

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B

PATENTS

PATENTEES

EQUIPMENTS—APPARATUS AND MATERIALS

EQUIPMENTS—FIRMS

VOL. 12. NO. 12 Registered in U. S. Patent Office DECEMBER, 1914

THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD, COPPER AND BRASS
THE BRASS FOUNDER AND FINISHER AND
ELECTRO-PLATERS REVIEW
99 JOHN STREET, NEW YORK

$1.00 Per Year 10 Cents Per Copy

A TRADE JOURNAL RELATING TO BRASS, COPPER, TIN, LEAD, ZINC, ALUMINUM, NICKEL, SILVER, GOLD, BRONZE

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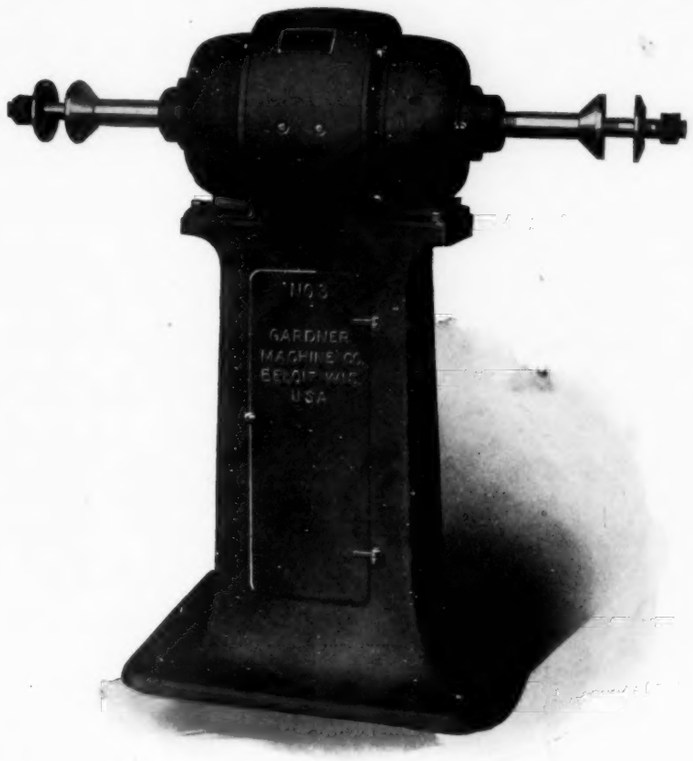


Motor Driven Polishing Lathe

Enclosed Motor—Ball Bearings

THE notable features of this lathe are the motor, starter and spindle construction. The fully enclosed direct current motor is of the commutating pole type. It is provided with special end frames of extra rigid design. In a recent test it was shown that the motor, used on our No. 3 Lathe, commutated 40 amperes at 220 Volts without any sign of sparking whatever. It has a continuous rating of 4 H. P. and two hour rating of 6 H. P.

The compound starter, with knife switch, is placed within the base and made accessible by opening the hinged door at front. A speed variation of 2000 R. P. M. to 3000 R. P. M. may be obtained.

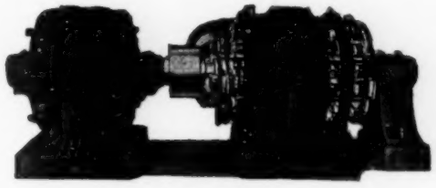
The extra heavy spindle is mounted in high grade ball bearings and in the No. 3 size is 49 inches in length. Its largest diameter is 2¼ inches, the diameter between the flanges being 1¼ inches.

This same type lathe is made in two smaller sizes, our No. 2 and No. 1. The former carries a spindle 42½ inches long, the diameter between flanges being 1 inch; the latter has a spindle 32 inches long, the diameter between flanges being ¾ inch. Although these spindle lengths are standard and carried in stock, we are in position to furnish special length spindles with but little delay.

Ask for Free Booklet—Ball Bearing Polishing Lathes.

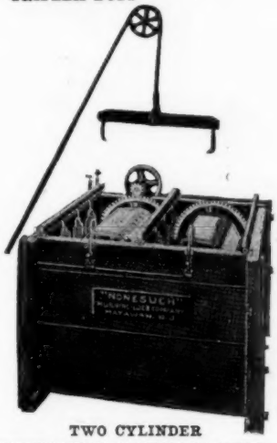
GARDNER MACHINE COMPANY, Beloit, Wisconsin

TRIPLEX BUFF



OPTIMUS DYNAMO

M-L BUFF



TWO CYLINDER
"NONESUCH" PLATING MACHINE

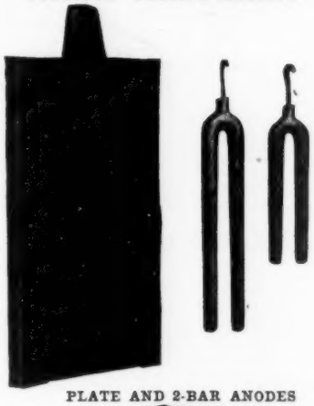
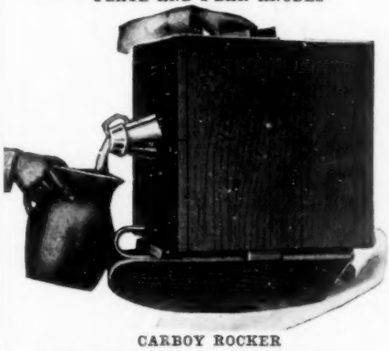


PLATE AND 2-BAR ANODES



CARBOY ROCKER

WHAT DO YOU WANT?
WE HAVE IT!

Munning-Loeb **POLISH** is now put up in tin containers **at no extra cost.** Try the handy cylindrical tin and the polish made of pure Vienna Lime and be convinced. A big stock of raw materials permits us to maintain former prices despite the rapidly increasing cost of lime. Samples gladly sent at request. Royal White Polish Grade "D" and "G," Vienna White Polish Grade "D" and "G."

Write for prices on **COPPER CARBONATE.** They will surprise you. Now is the time to buy for next year's requirements, for copper prices are moving upward and carbonate prices are bound to follow. We guarantee our carbonate for 50-52% copper contents. A big stock insures prompt shipments.

TRIPLEX BUFFS have better operating characteristics, are longer lived and use less polishing composition than any ordinary type of buffs. Patented folding of elements presents the effective fibres to the work, permits rebuilding when worn down, and holds the composition. The **TRIPLEX BUFF** is fully described in our Bulletin 200, together with our complete line of polishing and buffing wheels.

MUNNING-LOEB 2-BAR ANODES have a maximum surface, constantly greater for a given weight through all stages of consumption, than any other comparable type. **It's effective surface you buy in 2-Bar anodes and not weight.** Nickel anodes cast in the 90 to 92% and 95 to 97% standards of purity. We cast anodes in any shape and any metal. Write for our new Bulletin 600.

M-L BRUSHES are hand made of pure stock with best grades of material and wire-drawn. We make all types. Ask for Bulletin 500.

NONE-SUCH PLATING MACHINES greatly increase the speed, efficiency, and quality of plating small articles. Wise up on the savings and advantages. Write for Bulletin 400.

OPTIMUS PLATING DYNAMOS, compound wound, give perfect automatic regulation, low heat rating, high load capacity, and guaranteed sparkless commutation. **"OPTIMUS"** means best. Write for Bulletin 100.

Our **SALTS, CHEMICALS, ROUGES, COMPOUNDS,** etc., have properties that will please you. Try us.

Do you need **TANKS, LATHES, CARBOY ROCKERS** or other equipment? **We have it.**

Give us your requirements and a try out.

Munning-Loeb Company
MATAWAN, NEW JERSEY

MANUFACTURERS OF

ANODES BRUSHES BUFFS "NONE-SUCH" CARBOY ROCKERS CHEMICALS COMPOSITIONS DYNAMOS
LATHES "NONE-SUCH" ROTATING PLATING MACHINES SALTS ROUGES TANKS WHEELS 31

MANUFACTURERS OF PLATE, SHEET, ROD, WIRE, TUBE, INGOTS, METAL GOODS

DIRECTORY

METAL ROLLING MILLS

MANUFACTURERS OF PLATE, SHEET, ROD, WIRE, TUBE, INGOTS, METAL GOODS

MANUFACTURERS OF PLATE, SHEET, ROD, WIRE, TUBE, INGOTS, METAL GOODS

DIRECTORY

METAL ROLLING MILLS

MANUFACTURERS OF PLATE, SHEET, ROD, WIRE, TUBE, INGOTS, METAL GOODS

PRODUCERS OF PIG LEAD, SLAB SPELTER, SHEET ZINC, ROD, ACIDS

DIRECTORY

LEAD AND ZINC SMELTERS AND MANUFACTURERS

PRODUCERS OF PIG LEAD, SLAB SPELTER, SHEET ZINC, ROD, ACIDS

METAL SMELTERS, REFINERS, DEALERS

PRODUCERS, BUYERS AND SELLERS OF NEW AND OLD METALS

PRODUCERS ALSO BUYERS AND SELLERS OF NEW AND OLD METALS

DIRECTORY

METAL SMELTERS, REFINERS, DEALERS

PRODUCERS ALSO BUYERS AND SELLERS OF NEW AND OLD METALS

DIRECTORY

METAL FOUNDERS, FINISHERS, WORKERS AND SPECIALTY MANUFACTURERS

SPINNERS
PLATERS
ETCHERS
POLISHERS
GALVANIZERS

DIRECTORY

METAL WORKERS AND FINISHERS

SPINNERS
PLATERS
ETCHERS
POLISHERS
GALVANIZERS

The Two Rivers Plating Works
TWO RIVERS, WIS.
PLATERS
IN SILVER, NICKEL, COPPER, BRASS, ELECTRO-GALVANIZING, OXIDIZING
Refinishing Anything That is Metal
Well equipped with latest Mechanical Plating and Burnishing Machines. Can save money on plating for any manufacturer

GEORGE EBERHARD
METAL SPINNER
High-grade spinning in oval and round work. Sterling silver and gold rolled plate a specialty; also copper, brass, etc.
9 CALENDER ST. PROVIDENCE, R. I.

HUDSON ELECTRO PLATING AND POLISHING CO.
254 West 54th St. NEW YORK
Electro Platers, Gold, Silver, Nickel Copper, Brass
and Oxidizing in all Colors
Refinishing Brass Beds, Supplying all Missing Parts
Plumbers' and Gas Fitters' Work a Specialty

Electro Plating For Others Our Specialty
All the finishes in NICKEL, BRASS AND COPPER PLATING, also BUFFING, POLISHING, LACQUERING, OXIDIZING AND METAL STAMPING.
We will be glad to quote prices on receipt of samples.
The C. J. ROOT COMPANY, BRISTOL, CONN.

This Space for Sale
Send for Rates

ETCHING
Decorative etching on all kinds of metal articles for the trades.
Manufacturers advised in the ornamenting of metal surfaces of any description.
VACUUM SPECIALTY COMPANY
JOHN R. BAYNES ETCHING DEPARTMENT
1261 Broadway, New York City

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CHEMISTS
METALLURGISTS

DIRECTORY

LABORATORIES AND PROFESSIONAL MEN

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CHEMISTS
METALLURGISTS

LEDOUX & COMPANY
NEW YORK
Laboratory and Office: 99 John Street
Specialists in Analyses of Metals and Alloys

GUION THOMPSON
Engineer with
The A. J. Patton Company
27 West Main Street, Waterbury, Conn.
Power Plants; Factory Drives; General Industrial Engineering

E. BLASSETT, Jr. Address, care The Metal Industry 99 John St., New York
Consulting Electro-Plater
Expert on Special Finishes for Steel and Iron
GUN METAL, BLACK NICKEL, RUST-PROOFING, ETC.
Formulas and instruction in all processes of plating, metal coloring, dipping and lacquering.

W. A. WOOD
Engineer
120 Liberty Street New York
Designer and Builder of Brass and Copper Rolling Mills. Sheet, Rod, Wire Tube Extrusion Process. Furnaces, Automatic Machinery
Complete plants built and operated

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AN EXCHANGE FOR THE WANTS OF THE METAL TRADES

RATES:—40 cents per line; three lines one dollar, per insertion. Display Ads. $3.00 per inch, per insertion. Situations Wanted, 50 cents per insertion. Answers sent in care of The Metal Industry will be forwarded.

FOR SALE

RECEIVERS SALE

The following machinery and supplies are offered for sale by order of the Court:

1 Shaper.
1 No. 3 Baird Stamping Power Press.
1 Smaller Baird Stamping Power Press.
1 Foot Press.
1 Bench Drill.
1 5 H. P.—A. C. electric motor with switches and wiring.
2 Buffing Lathes with wheels and counter shaft.
1 Electric Nickel Plating outfit with dynamo.
120 lbs. of Nickel Anodes.
20 Plating Frames.
1 Small Emery Wheel, head and counter shaft.
2 Tumbling Barrels (one iron frame).
52 feet, 1 15-16" shafting.
1 Set patterns for manufacture of tack pullers.
1 Set patterns for manufacture of window locks.
1 Set Dies for manufacture of can openers.
1 Set Dies for manufacture of callipers.
263 Dozen can openers packed in boxes.
27 Dozen tack pullers packed in boxes.
300 Feet leather belting, 1 to 4".
1 Underwood Typewriter.

Numerous small tools and supplies.

For full particulars, address

H. L. Shepard, Receiver for
THE BAVIER MFG. COMPANY, BETHEL, CONN.

Plating Room Equipment
FOR SALE

Lot of Brass Anodes, 18c. per lb.
50 lbs. Powdered Tripoli 2c. per lb.
Lot 8" x 2" Tampico Wheel Brushes.
243 Sections Stitched Buffs, 3c.
275 Polishing Wheels asst. sizes —Canvas, Felt and Bullneck.
7 New 12" Canvas Wheels, $1.00 each.
1 Iron Mortar, $1.00.
1 Volt Meter, New, $15.00.
1 Copper Caldron, $1.00.
1 Concrete Tank, $6.00.
1 Iron Tumbling Barrel, $18.00
1 Wood Tumbling Barrel, $10.00.
2 Wood Tumbling Barrels, $2.00 each.
1 Plating Barrel.
1 Dynamo, 1,000 Amperes, 6 Volts.
1 Lot Wood Pulleys.
2 Iron Caldrons on stoves for Lye and Water, $7.50 each.

Address
ST. LOUIS TRUNK HARDWARE MFG. CO.
609-15 Chauteau Avenue, ST. LOUIS, MO.

RAGS AND COTTON WASTE

FOR SALE—Wiping rags and cotton waste. Buyers of scrap material of all kinds.
WALSH'S SONS & CO., 868 OGDEN STREET, NEWARK, N. J.

SECOND HAND MACHINERY

FOR SALE—Changing Equipment, will sell excellent machines, cheap. Suitable for metal working shops and factories.

Tumbling Barrels.....$10 to $15
Alligator Shears.....$20 to $25
16-inch Shearing Press.....$100
Drill Presses.....$30 to $65
Power Presses.....$15 up
80 H. P. Vertical Boiler.....$140
Emery Grinders.....$3 to $6
Small Rolling Mills or Straightening Rolls..$85 to $100
Shafting, Hangers, Pulleys, 1c. pound.

Address SHELTON COMPANY, Shelton, Conn.

BUFFING AND POLISHING MACHINE

FOR SALE—One Robinson Automatic Buffing and Polishing Machine for Pipe or Tubing. Five Heads. Machine in good condition. Will sell cheap. Address
AUTOMATIC BUFFER,
Care THE METAL INDUSTRY.

FOR SALE

1 Mumford Moulding Machine.
1 Monarch Tilting Furnace.
28 Cast iron flasks (16 x 14 x 4½), made by the Brass Founders' Supply Co., Newark, N. J.
1 No. 6 Monarch Air Blower.
1 Dry Rumbler (Kane).

MUST BE SOLD—WE NEED THE ROOM
WILLIAM KANE MFG. COMPANY
1905 Adams Street, Philadelphia, Pa.

"TOOLS THAT WORK"

DIES, STAMPINGS, SPECIAL MACHINERY, MODELS, PATENT DEVELOPMENT, CONTRACT MANUFACTURING

LA CROIX TOOL CO. 214 NORTH 21ST. ST., ST. LOUIS, MO.

WANTED

WANTED—300 GALLON WOODEN TANK

WANTED—A second-hand 300 gallon wooden tank for throwing down silver from the rinse water. This tank must have copper bolts. Send full particulars, etc., to
WOODEN TANK, Care THE METAL INDUSTRY.

ZINC CLIPPINGS

WANTED—Zinc Clippings or Engraver's Plates, new material only, in small or large quantities. State price and quantity. Address
ZINC CLIPPINGS, care THE METAL INDUSTRY.

American Institute Volumes

WANTED—Transactions of the American Institute of Metals, volumes 1, 2 and 3. Please make offer to
UNIVERSITY OF MINNESOTA LIBRARY,
MINNEAPOLIS, MINN.

MEETING ROOM

The New York branch of the American Electro Platers' Society desires to rent a room for meeting and experimental purposes. Floor space should not be less than 25 x 50 feet. A central location desired East or West of Broadway, not above 42d Street. Factory or Loft Building will answer the purpose. Address all communications, with cost of rental per year, to CHARLES H. PROCTOR, 270 Argyle Place, Arlington, N. J., or H. C. BERNARD, 340A Decatur Street, Brooklyn, N. Y., Committee.

SALES AGENCY

WANTED—Sales Agency for Specialty Line on Commission basis. Ten years' experience traveling from New York and Boston to Chicago and St. Louis. Address F. S. WEAVER,
426 BAYNE AVENUE, BELLEVUE STATION,
PITTSBURGH, PA.

AGENTS OR SALESMEN

WANTED—Resident and Traveling Agents or salesmen with selling connections among users of Cork Polishing Wheels to electroplaters and all concerns which are apt to use and purchase such polishing wheels and cork polishing powders. Only those having these connections need apply. Communications treated confidentially.
CORK SPECIALTIES & FLOORING CO., 28 South William St., New York City.

AN EXCHANGE FOR THE WANTS OF THE METAL TRADES

RATES:—40 cents per line; three lines one dollar, per insertion. Display Ads $3.00 per inch, per insertion. Situations Wanted, 50 cents per insertion. Answers sent in care of The Metal Industry will be forwarded.

INQUIRIES

Inquiries received by The Metal Industry for Metals, Machinery and Supplies. Further particulars may be obtained by addressing the inquiry number, care The Metal Industry. No charge for inserting these inquiries.

Inquiry 966—We are running into a class of work requiring automatic buffing and polishing machines. Will you kindly send us the names of manufacturers?

Inquiry 967—Kindly let us know who makes camel hair lacquer brushes set in vulcanized rubber.

Inquiry 968—We have a customer for magnalium metal. Who manufactures it?

Inquiry 969—Kindly refer us to manufacturers or importers of lump and ground pumice stone.

Inquiry 970—We are in the market for brass combs with wood handles like enclosed cut and as used by manufacturers of hair goods, in lots of 1,000 at a time. Kindly advise where the combs are manufactured.

Inquiry 971—Kindly send the names of stearic acid manufacturers.

Inquiry 972—Who manufactures the Leslie bulb sponge?

Inquiry 973—Can you direct me to manufacturers of wood handles and knobs, either black enamel or ebony, as used on chafing dishes and household utensils?

Inquiry 974—Where can I secure quarter inch hemp sash cord like sample enclosed?

Inquiry 975—Where can I secure plans for an open hearth furnace, suitable for refining dross from stereotype metal?

Inquiry 976—Please send the address of some firm that can plate lead on copper shells.

Inquiry 977—Who can give me a reasonable estimate on manufacturing an order of specially constructed drop-forged pliers?

Inquiry 978—Can you send us the names of producers of monel metal; also nickel?

Inquiry 979—Can you give me the names of wholesalers of 98% and 99% nickel?

Inquiry 980—Can you tell us where we can buy Vienna lime in quantities?

Inquiry 981—We are getting inquiries from all over the world for aluminum, raw and semi-manufactured. Can you tell us who can furnish this product?

Inquiry 982—Can you put us in touch with the agents of the Schoop metal spraying process?

Inquiry 983—Who makes a material for cleaning pickled steel stock?

Inquiry 984—Where can we secure hot galvanizing equipment?

Inquiry 985—Our customer wants information and prices covering a complete plant for enameling water bottles.

Inquiry 986—We have a large quantity of wire pieces like sample to electro-galvanize and want information. If the work can be done at reasonable cost we shall install a plant at once.

Inquiry 987—Russia. Petrograd firm wants to represent producers of metals, metal alloys and metal goods. Preliminary negotiations solicited by representative now in New York.

SITUATIONS OPEN

BRASS MACHINE FOREMAN

WANTED—Working Foreman for Brass Machine Shop, employing about 15 men, in a plant making brass specialties reducing valves, etc. Must be able to turn out good work and get results from men. Give full information regarding age, experience, nationality, wages expected, etc. Address

C. B., Care THE METAL INDUSTRY.

PLATER ON DIE CASTINGS

WANTED—An Electro-plater, one having had experience in plating Die Castings preferred. Write, stating age, experience and salary expected. Address

ELECTRO-PLATER,
Care THE METAL INDUSTRY.

BRASS ROOM FOREMAN

WANTED—Press and manufacturing room foreman, for brass work, chandelier parts, etc. One who understands tools and the proper setting of same, who can handle help to good advantage and get work out economically. We can offer such a person a steady position. State age, references and wages expected. Address

FARIES MANUFACTURING COMPANY, DECATUR, ILLINOIS.

FOUNDRY FOREMAN

WANTED—Foundry Foreman of wide experience for Ornamental Iron and Bronze Works in large city in Central States. Must be man of force and ability to handle over one hundred men and thoroughly acquainted with this branch of the foundry business. Answer, giving age, experience, etc.

ORNAMENTAL BRONZE, Care THE METAL INDUSTRY.

ALUMINUM ROLLER

WANTED—A man thoroughly familiar with the rolling and polishing of sheet aluminum. Must know how rolls are to be crowned, how hard to pinch sheets, etc. Address

ALUMINUM ROLLER,
Care THE METAL INDUSTRY.

FOREMAN PLATER

WANTED—Practical Foreman Plater with at least ten years' experience, to take full charge of plating and tumbling departments of shop producing large quantities of small parts. Most of the work is done in barrel plating machines. Man must be capable of producing popular hardware finishes economically. Location, eastern Pennsylvania. State references, names of employers during last ten years and salary expected. All information given will be held in confidence.

Address PRACTICAL PLATER, care THE METAL INDUSTRY.

PLATING SALESMAN

WANTED—RARE OPENING FOR SALESMAN with established house manufacturing full line of Electro-platers and Polishers' Supplies. Offers substantial, permanent interest in the business to a man thoroughly understanding and controlling trade in this line. State experience. Address

RARE OPENING, Care THE METAL INDUSTRY.

Expert on Silver Plated Table Ware

WANTED—A THOROUGHLY PRACTICAL up-to-date man with efficient, modern methods in manufacturing Silver Plated Table Ware. Address

TABLE WARE, Care THE METAL INDUSTRY.

SITUATIONS WANTED

Undisplayed Advertisements Under This Heading 50 Cents Each Insertion
Displayed Advertisements $1.50 per inch each insertion. Ads under this heading are payable in advance.

EXECUTIVE

SITUATION WANTED—By a Mechanical Superintendent with broad manufacturing experience. Exceptional ability in overcoming mechanical and manufacturing difficulties. Best of references. Address MECHANICAL SUPERINTENDENT, care THE METAL INDUSTRY.

REPRESENTATIVES

SITUATION WANTED—By a practical man with 20 years' experience in the metal business. Would like to represent metal firm; one desiring to exhibit at the World's Fair in San Francisco. Can plan and install an exhibition, also act as your coast representative. Address A. P. Wright, 1648 Prince Street, Berkeley, California.

SITUATION WANTED—Technical Graduate, 30, with chemical, manufacturing and sales experience, wishes to hear from Eastern companies desiring Pacific Coast representation. Address COAST, care THE METAL INDUSTRY.

ELECTRO-GALVANIZER

SITUATION WANTED—Electro-Galvanizer and Plater. Seven years' experience as Foreman. Can furnish the best of references. Address ELECTRO-GALVANIZER, care THE METAL INDUSTRY.

HOT GALVANIZER

SITUATION WANTED—As SUPERINTENDENT or FOREMAN of JOB GALVANIZING WORKS. 25 years' experience in handling men, installing plants and latest appliances for small work—tacks, nails, screws, etc., and in practical galvanizing "Hot Dipping." Thorough knowledge of the business and details. Address GALVANIZING FOREMAN, care THE METAL INDUSTRY.

ETCHER

SITUATION WANTED—Etcher on Name Plates and Novelties of any metal. Expert on installing etching plants by horizontal or vertical tanks, brush, air or electric systems. Knows the etching business from A to Z. Would like to connect with a reliable firm offering reasonable salary or commission. Address ETCHER, care THE METAL INDUSTRY.

BRASS FINISHER

SITUATION WANTED—As Foreman in a plant manufacturing Brass Valves and Plumbers' Supplies. 16 years' experience with the largest valve manufacturing company. Understands all up-to-date machinery, methods and equipment covering this class of work. Can figure against the closest competition; expert in making first class operators from green help; can design own tools that will cut the cost of production to the lowest figures. A live man in the valve industry wishing to make change first of year. No objection to location. Address BRASS FOREMAN, care THE METAL INDUSTRY.

FOUNDRYMEN

SITUATION WANTED—A practical and up-to-date brass foundry foreman is looking for a position where first class work and good management will be appreciated. Twenty years' experience in all branches of the best brass foundry practice; steady and a hustler. Can furnish first class references from some of the largest brass founders in the Eastern section, or I would like to hear from some large firm who would be willing to contract their brass casting work to a reliable man, thus eliminating the expense of an army of cost clerks and bookkeepers. Further particulars can be had by addressing PRACTICAL, care THE METAL INDUSTRY.

SITUATION WANTED—French Moulder. Desires contract, can accomplish the most difficult work—Architecture, Ornament, Statuary, Jewelry. Ex-Foreman of large Foundry in Paris. Talks little English. Address HUBERT, care THE METAL INDUSTRY.

SITUATION WANTED—Foundry foreman, at present employed as superintendent, would like to make a change with some good, reliable firm. Up-to-date on all kinds of jobbing, brass, bronze and aluminum work; 24 years' experience. Address C. F. T., care THE METAL INDUSTRY.

SITUATION WANTED—By a Brass Foundry Foreman familiar with mixing all Metals for Plumbers' Supplies. General Jobbing Work, also with Auto Work. Familiar with all kinds of formula and molding machines, and can handle men to best advantage. Ten years' experience as foreman and have been a molder for 27 years. Can furnish references. Address J. W. F., care THE METAL INDUSTRY.

SITUATION WANTED—As Brass Foundry Foreman, 25 years' experience in all branches, ten years as foreman, specialty shop preferred; experienced on Manganese Bronze. Can furnish best of references. Address FOUNDRY FOREMAN, care THE METAL INDUSTRY.

PLATERS AND POLISHERS

ELECTRO-PLATERS

Any one desiring the services of first class men for the electro-deposition of metals and finishing in all branches and departments of the plating business can secure such services by corresponding with the Secretary of the American Electro-Platers' Society,

WALTER FRAINE,
507 GRAND AVENUE, DAYTON, OHIO.

SITUATION WANTED—By an electro-chemical engineer, with advanced university training in plating, research, etc., and shop experience in plating, analysis and research. I will consider any kind of work, either in laboratory or shop that will give a chance to learn modern shop methods. I am thoroughly competent and undertake special investiagtions in chemical problems. Address K. S., care THE METAL INDUSTRY.

SITUATION WANTED—Foreman polisher and buffer desires position as foreman with a reliable firm. Have had 18 years' experience and been connected with some of the largest establishments in the United States, where the demands are the very highest, both as to quality and the low cost of production. Reasons for making a change are the best and will be satisfactory to anyone desiring a thorough practical man. Do not desire a small establishment, but one in which the best skill and executive ability is required. Can furnish high grade references. Address EXECUTIVE, care THE METAL INDUSTRY.

SITUATION WANTED—By Plater and Polisher with broad experience in handling men and getting good results. Can furnish the best of references as to ability and character. Prefer a large city. No job too large. Address PRODUCER, care THE METAL INDUSTRY.

SITUATION WANTED.—Foreman Plater, Polisher and Buffer; 15 years' experience as a foreman; 10 years with one of the best gas and electric fixture manufacturers in the East. Thoroughly understands all acid dips, up-to-date on all plating solutions and lacquering and the latest finishes Would like to correspond with a good electric or gas fixture or hardware manufacturer. Prefers a position in California. Address CALIFORNIA, care THE METAL INDUSTRY.

SITUATION WANTED—By a Plater who has had 14 years' experience in Gold, Silver, Nickel, Copper, Brass plating and oxidizing. Makes his own solutions. Specialty small and medium work. Steady and sober. Seeks good position. Address, with particulars, SELNICK, 1042 So. Boulevard, New York City.

SITUATION WANTED—By a Foreman Plater and Polisher. Have had 24 years' experience, capable of mixing and keeping in good condition the following solutions: Silver, Copper, Brass and Nickel. Address CAPABLE, care THE METAL INDUSTRY.

SITUATION WANTED—By Foreman Plater who is not afraid of work, wages or location. 22 years' experience on Gold, Silver, Nickel, Copper, Brass and Bronze Solutions, Acid Dipping, Lacquering, Buffing and Polishing. An expert on Barrel and Mechanical Platers. Latest Rolling Processes. Address GARDE, care THE METAL INDUSTRY.

SITUATION WANTED—By Foreman Plater and Polisher, with years of experience in executive position, who desires to communicate with some manufacturer. Calibration of scientific electrical instruments. Is aggressive and conversant with shop efficiency, maintaining economical results. Original in bright plating on all kinds of metals. Any manufacturers interested in new methods of plating and systematizing plating and polishing departments can get in communication by addressing A. M., care THE METAL INDUSTRY.

SITUATION WANTED—By an all around plater. Can make and run all solutions. Married. Age 43. No objections to Middle West. Address SOLUTIONS, care THE METAL INDUSTRY.

SITUATION WANTED—Position as Silver Plater on Steel Knives, German Silver Goods, etc. Latest methods in caring for solutions and producing work. Addreses METHOD, care THE METAL INDUSTRY.

SITUATION WANTED—Foreman Plater or Working Foreman, accustomed to all classes of work, thoroughly understands all modern methods in reference to polishing, plating, lacquering, japanning, etc. Capable of handling help advantageously. Can furnish A-1 references. Address ENERGETIC, care THE METAL INDUSTRY.

SITUATION WANTED.—Foreman Plater—Electro-Chemist with 15 years' experience in executive positions, is desirous of connecting with a reliable Art Metal Goods, Chandelier or Brass Goods Manufactory. Is aggressive and conversant in shop efficiency; maintaining economical results. Original in artistic metal finishes and thoroughly practical in the reproduction of the antique effects and colors in gold, silver and copper; also expert in etching on brass and silver manufactured goods. Address EFFICIENT, care THE METAL INDUSTRY.

ADVERTISERS' PRODUCTS AND BUYERS' GUIDE

Abrasives.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
Rhodes, James H., & Co., New York.

Accumulators, Hydraulic.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Acid, Hydrofluoric (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Cooper, Charles, & Co., New York.
General Chemical Co., Philadelphia, Pa.
Hanson & Van Winkle Co., Newark, N. J.
Kalbfleisch, Franklin H., Co., New York.
Munning-Loeb Co., Matawan, N. J.
Wiarda & Co., John C., Brooklyn, N. Y.

Acid, Muriatic (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Cooper, Charles, & Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
Niagara Alkali Co., Niagara Falls, N. Y.

Acid, Nitric.
Hanson & Van Winkle Co., Newark, N. J.
Kalbfleisch, Franklin H., Co., New York.
Munning-Loeb Co., Matawan, N. J.

Acid-Proof Stoneware.
German-American Stoneware Works, New York.

Acid, Sulphuric (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Cooper, Charles, & Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Hegeler Bros., Danville, Ill.
Illinois Zinc Co., Peru, Ill.
Kalbfleisch, Franklin H., Co., New York.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Matthiesen & Hegeler Zinc Co., La Salle, Ill.
Munning-Loeb Co., Matawan, N. J.

Air Brushes and Accessories.
De Vilbiss Co., Toledo, O.
Eclipse Air Brush & Compressor Co., Newark, N. J.
Eureka Pneumatic Spray Co., New York.
International Spray Co., New York.

Air Compressors.
De Vilbiss Co., Toledo, O.
Eclipse Air Brush & Compressor Co., Newark, N. J.
Eureka Pneumatic Spray Co., New York.
General Electric Co., Schenectady, N. Y.
International Spray Co., New York.
Leiman Bros., New York.

Air Filters.
De Vilbiss Co., Toledo, O.
Eclipse Air Brush & Compressor Co., Newark, N. J.
Eureka Pneumatic Spray Co., New York.

Alloys (Carbon Free).
Goldschmidt Thermit Co., New York.

Alloys Made to Specifications.
Ajax Metal Co., Philadelphia, Pa.
American Manganese Bronze Co., Philadelphia, Pa.
Atkinson Co., The, Rochester, N. Y.
Birkenstein, S., & Sons, Chicago, Ill.
Columbia Smelting & Refining Works, New York.
Damascus Bronze Co., Pittsburg, Pa.
Electric Smelting & Alum'n Co., Lockport, N. Y.
Genesee Metal Co., Rochester, N. Y.
Goldschmidt Thermit Co., New York.
Lang, R. F., New York.
Leavitt, C. W., & Co., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Co., Riverside, N. J.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Aluminum Alloys.
Aluminum Co. of America.
Birkenstein, S., & Sons, Chicago, Ill.
British Aluminum Co., Ltd., New York and Toronto.
Electric Smelting & Alum'n Co., Lockport, N. Y.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
U. S. Reduction Co., Chicago, Ill.

Aluminum Bronze Ingots.
Electric Smelting & Alum'n Co., Lockport, N. Y.

Aluminum Castings.
Aluminum Company of America, Pittsburg, Pa.
Atkinson Co., The, Rochester, N. Y.
Light Foundry & Mfg. Co., Pottstown, Pa.

Aluminum Electrical Conductors.
Aluminum Company of America, Pittsburg, Pa.
British Aluminum Co., Ltd., New York and Toronto.

Aluminum Granulated.
U. S. Reduction Co., Chicago, Ill.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Aluminum Ingots.
Aluminum Company of America, Pittsburg, Pa.
Birkenstein, S., & Sons, Chicago, Ill.
British Aluminum Co., Ltd., New York and Toronto.
Electric Smelting & Alum'n Co., Lockport, N. Y.
Kemp, W. H., Co., New York.
Leavitt, C. W., & Co., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Richards & Co., Boston, Mass.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Trotter, Nathan, & Co., Philadelphia, Pa.
United Smelt. & Aluminum Co., New Haven, Conn.
U. S. Reduction Co., Chicago, Ill.

Aluminum Manufactured Goods, Sheet (See also Metal Goods made to order).
Aluminum Goods Mfg. Co., Manitowoc, Wis.

Aluminum Match Plates.
British Aluminum Co., Ltd., New York and Toronto.
Turner Machine Co., Philadelphia, Pa.

Aluminum Moldings and Extruded Shapes.
Aluminum Company of America, Pittsburg, Pa.
British Aluminum Co., Ltd., New York and Toronto.

Aluminum Powder, Leaf and Foil.
British Aluminum Co., Ltd., New York and Toronto.
Kemp, W. H., Co., New York.

Aluminum Rivets.
British Aluminum Co., Ltd., New York and Toronto.
Hassall, John, Inc., Brooklyn, N. Y.
Kemp, W. H., Co., New York.

Aluminum Sheets, Rods and Wire.
Aluminum Company of America, Pittsburg, Pa.
British Aluminum Co., Ltd., New York and Toronto.
Electric Smelting & Alum'n Co., Lockport, N. Y.
Kemp, W. H., Co., New York.
Richards & Co., Boston, Mass.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Aluminum Solder (See Solder).

Aluminum Tubes.
Aluminum Company of America, Pittsburg, Pa.
British Aluminum Co., Ltd., New York and Toronto.
Kemp, W. H., Co., New York.

Ammeters and Voltmeters (See also Platers' Supplies).
Bristol Co., The, Waterbury, Conn.
Crown Rheostat & Supply Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.

Amyl Acetate (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Cooper, Charles, & Co., New York.
Inter. Smokeless Powder & Chemical Co., New York.
Wiarda & Co., John C., Brooklyn, N. Y.

Annealing Muffles.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Rockwell, W. S., Co., New York.

Annealing Pans.
Sly, W. W., Mfg. Co., Cleveland, O.

Anodes, Brass, Copper or Nickel (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Burns, E. R., Supply Co., Brooklyn, N. Y.
General Platers' Supply Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Hussey, C. G., & Co., Pittsburg, Pa.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Munning-Loeb Co., Matawan, N. J.
Moyer, D. B., Detroit, Mich.
Seymour Manufacturing Co., The, Seymour, Conn.
Stevens, Frederic B., Detroit, Mich.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.
Wiarda & Co., John C., Brooklyn, N. Y.
Wyckoff, H. S., Co., Newark, N. J.

Anodes, Gold or Silver.
Hanson & Van Winkle Co., Newark, N. J.
Jackson, John J., Newark, N. J.

Anodes, Platinum (See Platers' Supplies).

Anodes, Silver (See also Platers' Supplies).
Jackson, John J., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
Ney, J. M., Co., Hartford, Conn.
Renziehausen, Wm. F., Co., Newark, N. J.

Anodes, Zinc (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.
Wiarda & Co., John C., Brooklyn, N. Y.

Antimonial Lead.
Leavitt, C. W., & Co., New York.
North American Smelting Co., Philadelphia, Pa.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Antimony Metal.
Birkenstein, S., & Sons, Chicago, Ill.
Brooks Solder & Metal Works, Baltimore, Md.
Cooper, Charles, & Co., New York.
Hendricks Bros., New York.
Leavitt, C. W., & Co., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Richards & Co., Boston, Mass.
Trotter, Nathan, & Co., Philadelphia, Pa.
U. S. Reduction Co., Chicago, Ill.
Wiarda & Co., John C., Brooklyn, N. Y.

Assayers and Chemists.
Dover Laboratory, Dover, N. J.
Ledoux & Co., New York.

Automatic Buffing and Polishing Machines.
Baltimore Tube Co., Baltimore, Md.

Automatic Disk Polishing Machines.
Baltimore Tube Co., Baltimore, Md.

Automatic Wire and Metal Working Machinery.
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Shuster, F. B., Co., New Haven, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Babbitt Metals.
Ajax Metal Co., Philadelphia, Pa.
American Manganese Bronze Co., Philadelphia, Pa.
Atkinson Co., The, Rochester, N. Y.
Benson, H. K. & F. S., Glen Ridge, N. J.
Birkenstein, S., & Sons, Chicago, Ill.
Brooks Solder & Metal Works, Baltimore, Md.
Columbia Smelting & Refining Works, New York.
Damascus Bronze Co., Pittsburg, Pa.
Electric Smelt. & Aluminum Co., Lockport, N. Y.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Co., Riverside, N. J.
Riverside Metal Refining Co., Connellsville, Pa.

Babbitt Molds.
Schweizer, Chas. K., Co., St. Louis, Mo.

Bakelite.
General Bakelite Co., New York.

Baking Ovens.
Gehnrich, Herman, New York.
Oven Equipment & Mfg. Co., New Haven, Conn.

Ball-Bearing Polishing Lathes.
Gardner Machine Co., Beloit, Wis.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.

Balls, Steel, for Burnishing.
Abbott Ball Co., Hartford, Conn.
Baird Machine Co., Bridgeport, Conn.
Globe Machine & Stamping Co., Cleveland, O.
Smith, Richardson Co., Attleboro, Mass.

Belt Lacing, Metallic.
Bristol Co., The, Waterbury, Conn.

Belts, Polishing.
Ames Sword Co., Chicopee, Mass.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.

Bends and Coils, Brass, Copper, Iron.
Baltimore Tube Co., Baltimore, Md.

Bismuth.
Cooper, Charles, & Co., New York.
Hendricks Brothers, New York.
Leavitt, C. W., & Co., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Richards & Co., Boston, Mass.
Trotter, Nathan, & Co., Philadelphia, Pa.

Block Tin (See Tin).

Block Tin Pipe.
North American Smelting Co., Philadelphia, Pa
Standard Rolling Mills Inc., Brooklyn, N. Y

Blowers and Blow Piping.
Knickerbocker Company, Jackson, Mich.
Leiman Bros., New York.
Ohio Blower Co., Cleveland, O.

Bluing Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.

Boiler Graphite.
Dixon, Jos., Crucible Co., Jersey City, N. J.

Boron Flux.
General Electric Co., Schenectady, N. Y.

Brass and Bronze Architectural Work.
Manhattan Brass Co., New York.

Brass Ingots and Castings.
Ajax Metal Co., Philadelphia, Pa.
American Manganese Bronze Co., Philadelphia, Pa.
Birkenstein, S., & Sons, Chicago, Ill.
Damascus Bronze Co., Pittsburg, Pa.
Genesee Metal Co., Rochester, N. Y.
Illinois Smelting & Refining Co., Chicago, Ill.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Co., Riverside, N. J.
Riverside Metal Refining Co., Connellsville, Pa.
Taunton-New B'f'd Copper Co., New Bedford, Mass.
Walsh's Sons, M. L., & Co., Newark, N. J.
White & Bro., Inc., Philadelphia, Pa.

Brass, Bronze, Copper and Oreide Sheet Wire, Rod, Etc.
American Brass Co., The, Waterbury, Conn.
American Manganese Bronze Co., Philadelphia, Pa.
Benson, H. K. & F. S., Glen Ridge, N. J.
Bridgeport Brass & Copper Co., The, New York.
Damascus Bronze Co., Pittsburg, Pa.
Hendricks Bros., New York
Hussey, C. G., & Co., Pittsburg, Pa.
Lang, R. F., New York.
Manhattan Brass Co., New York.
National Brass & Copper Co., Lisbon, O.
National, The, Co., Waterbury, Conn.
Pilling Brass Co., Waterbury, Conn.
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Co., Riverside, N. J.
Scovill Manufacturing Co., Waterbury, Conn.
Seymour Manufacturing Co., The, Seymour, Conn.
Taunton-New B'f'd Copper Co., New Bedford, Mass.

Brass, Bronze, Copper and Oreide Tubes.
American Brass Co., The, Waterbury, Conn.
Baltimore Tube Co., Baltimore, Md.
Bridgeport Brass & Copper Co., The, New York.
Manhattan Brass Co., New York.
Merchant & Evans Co., Philadelphia, Pa.
Riverside Metal Co., Riverside, N. J.
Rome Hollow Wire & Tube Co., Rome, N. Y.
Scovill Manufacturing Co., Waterbury, Conn.
Seymour Manufacturing Co., The, Seymour, Conn.
Wells, A. H., Co., Waterbury, Conn.

Brass Foundry Equipment (See Foundry Supplies and Equipment).

ADVERTISERS' PRODUCTS AND BUYERS' GUIDE

Brass Furnace Linings (See also Foundry Supplies).
Hawley Down Draft Furnace Co., Easton, Pa.
Stevens, Frederic B., Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

Brass Goods, Plumbers'.
Atkinson Co., The, Rochester, N. Y.
Baltimore Tube Co., Baltimore, Md.
Bridgeport Brass Co., Bridgeport, Conn.
Manhattan Brass Co., New York.

Brazing Solder (See Solder).

Britannia Metal.
Benson, H. K. & F. S., Glen Ridge, N. J.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Bronze and Composition Ingots and Castings.
Ajax Metal Co., Philadelphia, Pa.
American Brass Co., The, Waterbury, Conn.
American Manganese Bronze Co., Philadelphia, Pa.
Atkinson Co., The, Rochester, N. Y.
Damascus Bronze Co., Pittsburg, Pa.
Genesee Metal Co., Rochester, N. Y.
North American Smelting Co., Philadelphia, Pa.
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Co., Riverside, N. J.
Riverside Metal Refining Co., Connellsville, Pa.
Taunton-New B'f'd Copper Co., New Bedford, Mass.

Bronze Sheets, Wire, Rods, Etc. (See Brass, Bronze and Copper Sheets, Etc.).

Bronze Tubes (See Brass, Bronze and Copper Tubes).

Brushes, Wire and Bristle (See also Foundry Supplies and Platers' Supplies).
Burns, E. R., Supply Co., Brooklyn, N. Y.
Hanson & Van Winkle Co., Newark, N. J.
Manufacturers' Brush Co., Cleveland, O.
Munning-Loeb Co., Matawan, N. J.
Osborn Manufacturing Co., Cleveland, O.
Paxson, J. W., Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.

Buckle Machinery (See Automatic Wire and Metal Working Machinery).

Buffing Machinery (See Polishing, Buffing and Burnishing Machinery).

Buffing and Polishing Compositions (See also Platers' Supplies).
Burns, E. R., Supply Co., Brooklyn, N. Y.
General Platers' Supply Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Moyer, D. B., Detroit, Mich.
Munning-Loeb Co., Matawan, N. J.
Stevens, Frederic B., Detroit, Mich.

Buffing and Polishing Supplies (See Polishing and Buffing Machinery and Equipment).

Buffing and Polishing Wheels (See also Platers' Supplies).
Burns, E. R., Supply Co., Brooklyn, N. Y.
General Platers' Supply Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Munning-Loeb Co., Matawan, N. J.
Stevens, Frederic B., Detroit, Mich.

Bull-Dozers.
Wood, R. D., & Co., Philadelphia, Pa.

Burners, Enclosed Flame Gas.
Gehnrich, Hermann, New York.
Oven Equipment & Mfg. Co., New Haven, Conn.

Burners, Fuel Oil or Gas (See also Foundry Supplies).
Hawley Down Draft Furnace Co., Easton, Pa.
Monarch Eng. & Mfg. Co., Baltimore, Md.
Rockwell, W. S., & Co., New York.

Burnishing Barrels (See also Platers' Supplies).
Abbott Ball Co., Hartford, Conn.
Baird Machine Co., Bridgeport, Conn.
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Moyer, D. B., Detroit, Mich.
Parsons, W. B., Chicago, Ill.
Smith, Richardson Co., Attleboro, Mass.
Stevens, Frederic B., Detroit, Mich.
Tolhurst Machine Works, Troy, N. Y.

Burnishing Barrels, Leather Metal for.
Hanson & Van Winkle Co., Newark, N. J.

Burnishing Compounds and Chips (See also Platers' and Polishers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
International Chemical Co., Camden, N. J.
Stevens, Frederic B., Detroit, Mich.

Button Machinery (See Automatic Wire and Metal Working Machinery).

Cabbaging Presses.
Farrel Foundry & Machine Co., Ansonia, Conn.
Wood, R. D., & Co., Philadelphia, Pa.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.

Cadmium Metallic.
Cooper, Charles, & Co., New York.
Leavitt, C. W., & Co., New York.
Richards & Co., Boston, Mass.

Carbonate of Potash.
Apothecaries Hall Co., Waterbury, Conn.
Roessler & Hasslacher Chemical Co., New York.
Wiarda, John C., & Co., Brooklyn, N. Y.

Carboy Rockers.
Munning-Loeb Co., Matawan, N. J.

Castings (See name of metal wanted).

Castings, Iron Machinery.
Bliss Co., E. W., Brooklyn, N. Y.
Farrel Foundry & Machine Co., Ansonia, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Wood, R. D., & Co., Philadelphia, Pa.

Caustic Potash (See Platers', Polishers' and Galvanizers' Supplies).

Centrifugal Dryers and Extractors.
Hanson & Van Winkle Co., Newark, N. J.
No-Dust Drying Machine Co., Providence, R. I.
Tolhurst Machine Works, Troy, N. Y.

Chain Machinery (See Automatic Wire and Metal Working Machinery).

Chaplets, Perforated (See Foundry Supplies).

Charcoal, Powdered and Granulated.
Paxson, J. W., Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.

Chasing and Modeling.
G. Kelch, New York.

Chemicals (See Platers' Supplies).

Chemists.
Dover Laboratory, Dover, N. J.
Ledoux & Co., New York.

Chloride of Iron.
Roessler & Hasslacher Chemical Co., New York.
Wiarda & Co., John C. Brooklyn, N. Y.

Chromium (Pure) and Chromium Cupro.
Goldschmidt Thermit Co., New York.

Chucks, Lathe and Drill.
Smillie, C. M., Detroit, Mich.

Chucks, Spinning.
Bliss, E. W., Co., Brooklyn, N. Y.
Pryibil, P., Inc., New York.
Wilcor Manufacturing Co., Chicago, Ill.

Cinder Mills (See Crushers).

Cleaning Compounds, Metal (See also Platers' Supplies).
Anthony, H. M., & Co., New York.
Apothecaries Hall Co., Waterbury, Conn.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Crown Rheostat & Supply Co., Chicago, Ill.
Electric Smelt. & Aluminum Co., Lockport, N. Y.
Ele-Kem Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
International Chemical Co., Camden, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Mendleson's, A., Sons, Albany, N. Y.
Moyer, D. B., Detroit, Mich.
Munning-Loeb Co., Matawan, N. J.
Rhodes, James H., & Co., New York.
Solvay Process Co., Syracuse, N. Y.
Stevens, Frederic B., Detroit, Mich.
Wiarda & Co., John C., Brooklyn, N. Y.
Wyckoff, H. S., Co., Newark, N. J.

Cock Grinders, Automatic.
Turner Machine Co., Philadelphia, Pa.

Coiling Machines (See also Rolling Mill Machinery).
Baird Machine Co., Bridgeport, Conn.
Torrington Manufacturing Co., Torrington, Conn.

Cold Rolling Mills (See Rolling Mill Machinery).

Composition Metal Tacks, Nails, Etc.
Hussey, C. G., & Co., Pittsburg, Pa.

Compositions, Buffing (See also Platers' Supplies).
Burns, E. R., Supply Co., Brooklyn, N. Y.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Munning-Loeb Co., Matawan, N. J.

Consulting Platers (See also Expert Instruction).

Copper Bearing Material, Buyers of (See Metal Turnings, Drosses, Residues, Etc.).

Copper, Carbonate of.
Apothecaries Hall Co., Waterbury, Conn.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Cooper, Charles, & Co., New York.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Munning-Loeb Co., Matawan, N. J.
Hanson & Van Winkle Co., Newark, N. J.
Roessler & Hasslacher Chemical Co., New York.
Stevens, Frederic B., Detroit, Mich.
Wiarda & Co., John C., Brooklyn, N. Y.

Copper Castings.
Ajax Metal Co., Philadelphia, Pa.
American Manganese Bronze Co., Philadelphia, Pa.
Atkinson Co., The, Rochester, N. Y.

Copper Cyanide.
Apothecaries Hall Co., Waterbury, Conn.
Roessler & Hasslacher Chemical Co., New York.

Copper Ingots.
Balbach Smelting & Refining Co., Newark, N. J.
Birkenstein, S., & Sons, Chicago, Ill.
Hendricks Brothers, New York.
Lang, R. F., New York.
Leavitt, C. W., & Co., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Co., Riverside, N. J.
Riverside Metal Refining Co., Connellsville, Pa.
Standard Rolling Mills Ins., Brooklyn, N. Y.
Taunton-New B'f'd Copper Co., New Bedford, Mass.
Trotter, Nathan, & Co., Philadelphia, Pa.
United Metals Selling Co., New York.
White & Bro., Inc., Philadelphia, Pa.

Copper Nails and Tacks.
Hassall, John, Inc., New York.
Hussey, C. G., & Co., Pittsburg, Pa.
Scovill Manufacturing Co., Waterbury, Conn.
Taunton-New B'f'd Copper Co., New Bedford, Mass.

Copper Rivets.
Hassall, John, Inc., New York.
Hendricks Bros., New York.

Copper Sheets, Wire, Rods, Bolts, Etc. (See Brass, Bronze and Copper Sheets, Etc.).

Copper, Shot.
Riverside Metal Co., Riverside, N. J.
Seymour Manufacturing Co., Seymour, Conn.

Copper, Sulphate of.
Apothecaries Hall Co., Waterbury, Conn.
Moyer, D. B., Detroit, Mich.
Munning-Loeb Co., Matawan, N. J.
Roessler & Hasslacher Chemical Co., New York.
Stevens, Frederic B., Detroit, Mich.
Wiarda, John C., & Co., Brooklyn, N. Y.

Copper Trisalyt.
Apothecaries Hall Co., Waterbury, Conn.
Roessler & Hasslacher Chemical Co., New York.

Copper Tubes (See Brass and Copper Tubes).

Core Compound (See also Foundry Supplies).
Dixon, Jos., Crucible Co., Jersey City, N. J.
Paxson, J. W., Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.

Core Machines (See Foundry Supplies).

Core Oil (See Core Compound).

Core Ovens (See also Foundry Supplies).
Coleman Foundry Equipment Co., Cleveland, O.
Gehnrich, Hermann, New York.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Oven Equipment & Mfg. Co., New Haven, Conn.
Stevens, Frederic B., Detroit, Mich.
Steiner, E. E., Newark, N. J.
Whiting Foundry Equipment Co., Harvey, Ill.

Corrugated Tubing, Brass.
Baltimore Tube Co., Baltimore, Md.

Countershafts, Ball Bearing.
Gardner Machine Co., Beloit, Wis.

Cranes.
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

Crocus and Buffing Compositions (See also Platers' Supplies).
Burns, E. R., Supply Co., Brooklyn, N. Y.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Moyer, D. B., Detroit, Mich.
Munning-Loeb Co., Matawan, N. J.
Stevens, Frederic B., Detroit, Mich.
Wiarda, John C., & Co., Brooklyn, N. Y.

Crucibles, Stirrers, Stoppers, Nozzles, Etc. (See also Foundry Supplies).
Bartley, Jonathan, Crucible Co., Trenton, N. J.
Dixon, Jos., Crucible Co., Jersey City, N. J.
Gautier, J. H., & Co., Jersey City, N. J.
McCullough Dalzell Crucible Co., Pittsburg, Pa.
Ross-Tacony Crucible Co., Philadelphia, Pa.
Seidel, R. B., Inc., Philadelphia, Pa.
Taylor, R. J., Inc., Philadelphia, Pa.

Crushed Steel Abrasives.
Pittsburg Crushed Steel Co., Pittsburg, Pa.

Crushers, Cinder (See also Foundry Supplies).
Coleman Foundry Equipment Co., Cleveland, O.
Farrel Foundry & Machine Co., Ansonia, Conn.
Osborn Mfg. Co., Cleveland, O.
Paxson, J. W., Co., Philadelphia, Pa.
Sly, W. W., Mfg. Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Whiting Foundry Equipment Co., Harvey, Ill.

Cube Nickel.
United States Nickel Co., New Brunswick, N. J.
Wiarda, John C., & Co., Brooklyn, N. Y.

Cupolas.
Northern Engineering Works, Detroit, Mich.
Paxson, J. W., Co., Philadelphia, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Cyanide of Potassium (See Platers' Supplies).

Cyanide of Sodium.
Apothecaries Hall Co., Waterbury, Conn.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Hanson & Van Winkle Co., Newark, N. J.
Roessler & Hasslacher Chemical Co., New York.
Wiarda, John C., & Co., Brooklyn, N. Y.

Deoxidizers for Copper.
General Electric Co., Schenectady, N. Y.

Die-Casting Machinery.
Doehler Die Casting Co., Brooklyn, N. Y.

Die Castings, Brass and Bronze.
Doehler Die Casting Co., Brooklyn, N. Y.

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Die-Castings, White Metal.
Doehler Die Casting Co., Brooklyn, N. Y.
Finished Parts Mfg. Co., Newark, N. J.
Light Foundry & Mfg. Co., Pottstown, Pa.

Dies, Sheet Metal Working.
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Globe Machine & Stamping Co., Cleveland, O.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Wilkes Mfg. Co., Philadelphia, Pa.

Dipping Baskets, Stoneware.
German-American Stoneware Works, New York.

Disc Polishing and Grinding Machines.
Baltimore Tube Co., Baltimore, Md.
Gardner Machine Co., Beloit, Wis.

Draw Benches—Wire, Rod and Tube.
Farrel Foundry & Machine Co., Ansonia, Conn.
Leiman Bros., New York.
Torrington Mfg. Co. Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Drosses (See Metal Turnings, Drosses, etc.).

Drop Hammers.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Drying-Out Machines.
Baird Machine Co., Bridgeport, Conn.
No-Dust Drying Machine Co., Providence, R. I.
Smith, Richardson Co., Attleboro, Mass.
Tolhurst Machine Works, Troy, N. Y.
Torrington Mfg. Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Drying Ovens.
Gehnrich, Hermann, New York.
Oven Equipment & Mfg. Co., New Haven, Conn.

Dust Collectors and Ventilating Systems.
Knickerbocker Co., The, Jackson, Mich.
Leiman Bros., New York.
Ohio Blower Co., Cleveland, O.
Sly, W. W., Mfg. Co., Cleveland, O.

Dynamos, Platers' and Galvanizers' (See also Platers' Supplies).
Bogue, Chas. J., Electric Co., New York.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Crown Rheostat & Supply Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
General Platers' Supply Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Munning-Loeb Co., Matawan, N. J.
Stevens, Frederic B., Detroit, Mich.
Wyckoff, H. S., Co., Newark, N. J.

Electric Cleaning Compounds (See Cleaning Compounds, Metal).

Electrochroma Solutions.
Rojas Electro Chemical Co., New York.

Electrogalvanizing Equipment (See Galvanizing Equipment).

Electrolytically Deposited Engine Manifold.
Baltimore Tube Co., Baltimore, Md.

Electroplaters' Centrifugal Dryers.
No-Dust Drying Machine Co., Providence, R. I.
Tolhurst Machine Works, Troy, N. Y.

Electroplating Equipment (See Platers', Polishers' and Galvanizing Equipment and Supplies).

Electroplating, Polishing, Coloring, Etc.
Hassell, John, Inc., Brooklyn, N. Y.
Hudson Electro Plating & Polish Co., New York.
Root, C. J., & Co., Bristol, Conn.
Two Rivers Plating Works, Two Rivers, Wis.

Elevators.
Whiting Foundry Equipment Co., Harvey, Ill.

Emery Wheels (See Grinding Machinery).

Enameling and Japanning Ovens.
Gehnrich, Hermann, New York.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Oven Equipment & Mfg. Co., New Haven, Conn.
Steiner, E. E., Newark, N. J.

Enamels, Lacquer (See Lacquer Enamels).

Engineers, Consulting Mechanical.
Thompson, Guion, Waterbury, Conn.

Engineers, Foundry.
Pangborn Corporation, Hagerstown, Md.
Whiting Foundry Equipment, Harvey, Ill.

Escutcheon Pins, All Metals.
Hassall, John, New York.

Etching on Metals.
Vacuum Specialty Co., New York.

Exhaust Fans and Heads.
Knickerbocker Co., Jackson, Mich.
Leiman Bros., New York.
Ohio Blower Co., Cleveland, O.

Exhaust Fans, Stoneware.
German-American Stoneware Works, New York.

Expert Instruction—Plating, Coloring, Dipping, Etching, Etc.
Rojas Electro Chemical Co., New York.
Rockwell Furnace Co., New York.
Rockwell, W. S., Co., New York.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Extractors, Centrifugal Drying.
Tolhurst Machine Works, Troy, N. Y.

Eye Protectors.
Chicago Eye Shield Co., Chicago, Ill.

Facings (See Foundry Facings).

Felt Polishing Wheels.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Munning-Loeb Co., Matawan, N. J.

Fig Cleanser.
Burns, E. R., Supply Co., Brooklyn, N. Y.
International Chemical Co., Camden, N. J.

Fillets, Leather (See Foundry Supplies and Equipment).

Fire Brick (See also Foundry Supplies).
Stevens, Frederic B., Detroit, Mich.

Flasks, Aluminum Snap.
Monarch Engineering & Mfg. Co., Baltimore, Md.

Flasks, Brass Molders' (See also Foundry Supplies).
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.

Flexible Tubing.
Baltimore Tube Co., Baltimore, Md.

Fluxes for Metals.
General Electric Co., Schenectady, N. Y.

Fluxes, Soldering and Tinning.
Richards & Co., Boston, Mass.

Forming Machines (See Automatic Wire and Metal Working Machinery).

Forgings, Automatic.
American Manganese Bronze Co., Philadelphia, Pa.
Bliss, E. W., Co., Brooklyn, N. Y.
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Foundry Facings (See Foundry Supplies).

Foundry Pails.
Sly, W. W., Mfg. Co., Cleveland, O.

Foundry Supplies and Equipment (See also Foundry Facings, Furnaces, etc).
Birkenstein, S., & Sons, Chicago, Ill.
Coleman Foundry Equipment Co., Cleveland, O.
Dixon, Jos., Crucible Co., Jersey City, N. J.
Gehnrich, Hermann, New York.
Hawley Down Draft Furnace Co., Easton, Pa.
Ideal Furnace Co., Chester, Pa.
Kroeschell Bros. Co., Chicago, Ill.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Osborn Mfg. Co., Cleveland, O.
Oven Equipment & Mfg. Co., New Haven, Conn.
Paxson, J. W., Co., Philadelphia, Pa.
Quigley Furnace & Foundry Co., Springfield, Mass.
Rockwell, W. S., Co., New York.
Steiner, E. E., Newark, N. J.
Stevens, Frederic B., Detroit, Mich.
Turner Machine Co., Philadelphia, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnace Linings (See Brass Foundry Linings).

Furnaces, Annealing, Brazing, Etc.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Rockwell, W. S., Co., New York.

Furnaces, Crucible (See Furnaces, Melting).

Furnaces, Electric.
Bristol Co., The, Waterbury, Conn.

Furnaces, Galvanizing and Tinning.
Farrel Foundry & Machine Co., Ansonia, Conn.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Rockwell, W. S., Co., New York.

Furnaces, Melting, for Oil, Coal, Coke or Gas (See also Foundry Supplies)
Coleman Foundry Equipment Co., Cleveland, O.
Hawley Down Draft Furnace Co., Easton, Pa.
Ideal Furnace Co., Chester, Pa.
Kroeschell Bros. Co., Chicago, Ill.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Northern Engineering Works, Detroit, Mich.
Paxson, J. W., Co., Philadelphia, Pa.
Rockwell, W. S., Co., New York.
Stevens, Frederic B., Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces, Reverberatory.
Hawley Down Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Rockwell, W. S., Co., New York.

Fusel Oil, Refined (See Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Cooper, Charles, & Co., New York.
International Smokeless Powder & Chemical Co., New York.
Wiarda & Co., John C., Brooklyn, N. Y.

Galvanized Specialties, Nails, Screws, Etc.
Hassall, John, Inc., Brooklyn, N. Y.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Galvanizing Equipment.
Ele-Kem Co., Chicago, Ill.
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Galvanizing for the Trade.
Hassall, John, Inc., Brooklyn, N. Y.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Gas Producers and Power Plants.
Wood, R. D., & Co., Philadelphia, Pa.

German Silver, Ingots, Castings, Sheets, Wire Rods, Tubes.
American Brass Co., Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Pilling Brass Co., Waterbury, Conn.
Riverside Metal Co., Riverside, N. J.
Scovill Manufacturing Co., Waterbury, Conn.
Seymour Manufacturing Co., The, Seymour, Conn.

Gold Alloys.
Riverside Metal Co., Riverside, N. J.

Gold Anodes (See Anodes).

Gold, Chloride of.
Copper, Charles, & Co., New York.

Gold Foil.
Ney, J. M., Co., Hartford, Conn.

Gold Ingots, Bars, Plates, Etc.
Ney, J. M., Co., Hartford, Conn.
Renziehausen, Wm. F., Co., Newark, N. J.
Riverside Metal Co., Riverside, N. J.

Gold and Silver Refiners.
Jackson, John J., Co., Newark, N. J.
Ney, J. M., Co., Hartford, Conn.
Renziehausen, Wm. F., Co., Newark, N. J.
Roessler & Hasslacher Chemical Co., New York.
Riverside Metal Co., Riverside, N. J.

Gold Trisalyt.
Roessler & Hasslacher Chemical Co., New York.

Graphite (See Foundry Supplies).

Grinding Machinery.
Baltimore Tube Co., Baltimore, Md.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Gardner Machine Co., Beloit, Wis.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Moyer, D. B., Detroit, Mich.
Osborn Mfg. Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Grinding Wheels (See Foundry Supplies).

Heat Gauges.
Bristol Co., Waterbury, Conn.

Hoists, Electric, Pneumatic, Head.
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

Hydraulic Accumulators.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Hydraulic Machinery, Presses, Jacks, Etc.
Farrel Foundry & Machine Co., Ansonia, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Ingot Metals (See Name of Metal Wanted).

Ingot Molds (See Molds, Ingot).

Iron, Scrap, Dealers in.
Smith Co., The Morton B., New York.

Japanning Ovens (See Enameling and Japanning Ovens).

Japans.
Apothecaries Hall Co., Waterbury, Conn.

Jewelers' Equipment and Supplies (See also Platers' Supplies).
Leiman Bros., New York.
No-Dust Drying Machine Co., Providence, R. I.
Tolhurst Machine Works, Troy, N. Y.

Jewelers' Findings.
Smith, Richardson Co., Attleboro, Mass.

Kalye.
Anthony Co., H. M., New York.

Kettles, Galvanizing and Tinning (See also Platers' Supplies).
Farrel Foundry & Machine Co., Ansonia, Conn.

Lacquer Enamels (See Lacquers and Enamels, Platers' Supplies).

Lacquering Ovens.
Gehnrich, Hermann, New York.
Oven Equipment & Mfg. Co., New Haven, Conn.
Steiner, E. E., Newark, N. J.

Lacquer Sprayers.
De Vilbiss Co., Toledo, O.
Eclipse Air Brush & Compressor Co., Newark, N. J.
Eureka Pneumatic Spray Co., New York.
International Spray Co., New York.

Lacquers and Enamels (See also Platers' Supplies).
Burns, E. R., Supply Co., Brooklyn, N. Y.
Celluloid Zapon Co., New York.
Chemical Products Co., Boston, Mass.
Cooper, Chas., & Co., New York.
Damard Lacquer Co., New York.
Egyptian Lacquer Manufacturing Co., New York.
Eureka Pneumatic Spray Co., New York.
General Bakelite Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
International Smokeless Powder & Chemical Co., New York.
Kalbfleisch, Franklin H., Co., New York.
Perry-Austen Mfg. Co., Grasmere, S. I., N. Y.

Ladle Heaters and Dryers (See also Foundry Supplies).
Hawley Down Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.

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Paxson, J. W., Co., Philadelphia, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Ladles (See also Foundry Supplies).
Hawley Down Draft Furnace Co., Easton, Pa.
Northern Engineering Works, Detroit, Mich.
Paxson, J. W., Co., Philadelphia, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Lathers, Polishing (See Platers' and Polishers' Supplies).

Lathes, Brass Finishers'.
Bliss, E. W., Co., Brooklyn, N. Y.
Stevens, Frederic B., Detroit, Mich.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Lathes, Spinning.
Pryibil, F., Inc., New York.
Wilcox Manufacturing Co., Chicago, Ill.

Lead, Antimonial.
Leavitt, C. W., & Co., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Richards & Co., Boston, Mass.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Lead Castings, Antimonial.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Lead-Coated Sheet Iron and Steel.
Ajax Metal Co., Philadelphia, Pa.

Leaden Ware and Lead Burning.
Chadwick-Boston Lead Co., Boston, Mass.
Wiarda & Co., John C., Brooklyn, N. Y.

Lead, Pig and Bar.
Atkinson Co., The, Rochester, N. Y.
Birkenstein, S., & Sons, Chicago, Ill.
Brooks Solder & Metal Works, Baltimore, Md.
Chadwick-Boston Lead Co., Boston, Mass.
Hendricks Bros., New York.
Illinois Smelting & Refining Co., Chicago, Ill.
Michigan Smelting & Refining Co., Detroit, Mich.
Richards & Co., Boston, Mass.
Standard Rolling Mills Inc., Brooklyn, N. Y.
Trotter, Nathan & Co., Philadelphia, Pa.
United States Selling Co., New York.
U. S. Reduction Co., Chicago, Ill.
Walsh's Sons, M. I., & Co., Newark, N. J.

Lead Pipe.
Brooks Solder & Metal Works, Baltimore, Md.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.

Lead Strips and Moldings.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Leather Meal for Dry Tumbling (See also Platers' Supplies).
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.

Lubricants.
Dixon, Joseph, Crucible Co., Jersey City, N. J.

Lycopodium (See also Foundry Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Cooper, Charles, & Co., New York.
Wiarda & Co., John C., Brooklyn, N. Y.

Magnesium Metal.
Cooper, Charles, & Co., New York.
Goldschmidt Thermit Co., New York.
Leavitt, C. W., & Co., New York.
Roessler & Hasslacher Chemical Co., New York.

Magnetic Metal Separators (See also Foundry Supplies).
Dings Electro-Mag. Separator Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Paxson, J. W., Co., Philadelphia, Pa.

Manganese Bronze (See Bronze and Composition Ingots and Castings).

Manganese, 98-99%
Goldschmidt Thermit Co., New York.

Manganese Bronze Sheets, Rods, Etc.
American Manganese Bronze Co., Philadelphia, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
Taunton-New B'f'd Copper Co., New Bedford, Mass.

Manganese Copper.
Ajax Metal Co., Philadelphia, Pa.
Atkinson Co., The, Rochester, N. Y.
Electric Smelting & Alum. Co., Lockport, N. Y.
Goldschmidt Thermit Co., New York.
Lang, R. F., New York.
Leavitt, C. W., & Co., New York.
Riverside Metal Co., Riverside, N. J.
Roessler & Hasslacher Chemical Co., New York.

Manganese Metal.
Cooper, Charles, & Co., New York.
Goldschmidt Thermit Co., New York.
Leavitt, C. W., & Co., New York.
Roessler & Hasslacher Chemical Co., New York.

Match Plates.
Turner Machine Co., Philadelphia, Pa.

Metallurgists, Consulting.
Dover Laboratory, Dover, N. J.
Ledoux & Co., New York.

Metals (See name of metal wanted).

Metals, Dealers in All Kinds of New (See also name of metal wanted).
Birkenstein, S., & Sons, Chicago, Ill.
Richards & Co., Boston, Mass.
Trotter, Nathan & Co., Philadelphia, Pa.

Metals, Dealers in Old.
Birkenstein, S., & Sons, Chicago, Ill.
Genesee Metal Co., Rochester, N. Y.
Illinois Smelting & Refining Co., Chicago, Ill.
Moers, E. M., Sons, New York.
Radnai, Josef, New York.
Riverside Metal Co., Riverside, N. J.
Smith, The Morton B., Co., New York.
United Smelt. & Aluminum Co., New Haven, Conn.
Walsh's Sons, M. I., & Co., Newark, N. J.

Metals, Dealers in Old—Gold, Silver, Platinum.
Renziehausen, Wm. F., Co., Newark, N. J.
Riverside Metal Co., Riverside, N. J.

Metal Goods Made to Order.
American Brass Co., Waterbury, Conn.
Baird Machine Co., Bridgeport, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Manhattan Brass Co., New York.
Riverside Metal Co., Riverside, N. J.
Scovill Manufacturing Co., Waterbury, Conn.
Wilkes Mfg. Co., Philadelphia, Pa.

Metals, Plated Sheet.
Benson, H. K. & F. S., Glen Ridge, N. J.
National Sheet Metal Co., Peru, Ill.

Metal Refiners, Gold and Silver.
Genesee Metal Co., Rochester, N. Y.
Ney, J. M., Co., Hartford, Conn.
Renziehausen Company, Newark, N. J.
Riverside Metal Co., Riverside, N. J.
Roessler & Hasslacher Chemical Co., New York.

Metal Refiners—White Metal.
Ajax Metal Co., Philadelphia, Pa.
Birkenstein, S., & Sons, Chicago, Ill.
Brooks Solder & Metal Works, Baltimore, Md.
Michigan Smelting & Refining Co., Detroit, Mich.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Metal, Silver Plated Sheet.
Benson, H. K. & F. S., Glen Ridge, N. J.

Metals (Carbon Free).
Goldschmidt Thermit Co., New York.

Metal Turnings, Drosses, Residues, Etc., Buyers of.
Ajax Metal Co., Philadelphia, Pa.
Balbach Smelting & Refining Co., Newark, N. J.
Birkenstein, S., & Sons, Chicago, Ill.
Brooks Solder & Metal Works, Baltimore, Md.
Illinois Smelting & Refining Co., Chicago, Ill.
Moers, E. M., Sons, New York.
Radnai, Josef, New York.
Smith, The Morton B., Co., New York.
Walsh's Sons, M. I., & Co., Newark, N. J.
White & Bro., Inc., Philadelphia, Pa.

Mineral Cleaner.
Apothecaries Hall Co., Waterbury, Conn.
Electric Smelting & Alum'n Co., Lockport, N. Y.

Mixer for Gold and Silver Sweepings.
Moussette, O. J., Co., Brooklyn, N. Y.

Modeling and Chasing.
G. Kelch, New York.

Mold Dryers, Portable (See also Foundry Supplies).
Monarch Engineering & Mfg. Co., Baltimore, Md.
Pangborn Corporation, Hagerstown, Md.
Paxson, J. W., & Co., Philadelphia, Pa.

Molds, Ingot (See also Foundry Supplies).
Farrel Foundry & Machine Co., Ansonia, Conn.

Mold Sprayers.
Pangborn Corporation, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Schweizer, Chas. K., Co., St. Louis, Mo.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Molds, Water-Cooled, for Babbitt, Etc.
Schweizer, Chas. K., Co., St. Louis, Mo.

Molding Machines (See also Foundry Supplies).
Osborn Mfg. Co., Cleveland, O.
Paxson, J. W., Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Turner Machine Co., Philadelphia, Pa.

Molding Sand (See Sand).

Motor Buffing Lathes.
L'Hommedieu, Chas. F., Sons & Co., Chicago, Ill.

Motors (See Dynamos, Etc.).

Mouldmakers.
G. Kelch, New York.

Muntz's Metal—Sheets, Rods, Bolts, Nails, Etc.
Taunton-New B'f'd Copper Co., New Bedford, Conn.

Nails (See name of metal wanted).

Nickel.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Hanson & Van Winkle Co., Newark, N. J.
Hendricks Bros., New York.
International Nickel Co., New York.
Leavitt, C. W., & Co., New York.
Merchant & Evans Co., Philadelphia, Pa.
Munning-Loeb Co., Matawan, N. J.
Moyer, D. B., Detroit, Mich.
Richards & Co., Boston, Mass.
Trotter, Nathan & Co., Philadelphia, Pa.
United States Nickel Co., New Brunswick, N. J.
Wiarda & Co., John C., Brooklyn, N. Y.

Nickel-Bronze Castings and Ingots.
Damascus Bronze Co., Pittsburgh, Pa.

Nickel Castings.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., Sons & Co., Chicago, Ill.
International Nickel Co., New York.
Munning-Loeb Co., Matawan, N. J.
Wiarda & Co., John C., Brooklyn, N. Y.

Nickel Plating (See Electroplating).

Nickel Salts (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Cooper, Charles, & Co., New York.
Crown Rheostat & Supply Co., Chicago, Ill.
Ele-Kem Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Lang, R. F., New York.
L'Hommedieu, Chas. F., Sons & Co., Chicago, Ill.
Munning-Loeb Co., Matawan, N. J.
Moyer, D. B., Detroit, Mich.
Roessler & Hasslacher Chemical Co., New York.
Stevens, Frederic B., Detroit, Mich.
Wiarda & Co., John C., Brooklyn, N. Y.

Nickel, Shot.
Hanson & Van Winkle Co., Newark, N. J.
International Nickel Co., New York.
Munning-Loeb Co., Matawan, N. J.
Seymour Manufacturing Co., The, Seymour, Conn.
United States Nickel Co., New Brunswick, N. J.
Wiarda & Co., John C., Brooklyn, N. Y.

Nickel Silver Tubes.
Wells, A. H., & Co., Waterbury, Conn.

Oil Pumps and Storage Tanks.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Rockwell Co., W. S., New York.

Oils, Tempering and Lubricating.
Apothecaries Hall Co., Waterbury, Conn.

Ovens (See Bluing, Baking, Drying, Lacquering, Japanning, Enameling and Sherardizing Ovens. Also Foundry Supplies).

Overhead Trolleys and Tracks.
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

Parting Compounds (See also Foundry Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Osborn Mfg. Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.

Pattern Shop Supplies (See Foundry Supplies).

Patterns, Mounted.
Goodale Co., Kalamazoo, Mich.
Turner Machine Co., Philadelphia, Pa.

Pewter.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Phosphor Bronze Ingots, Castings, Etc.
Ajax Metal Co., Philadelphia, Pa.
Atkinson Co., The, Rochester, N. Y.
Damascus Bronze Co., Pittsburg, Pa.
Illinois Smelting & Refining Co., Chicago, Ill.
Lang, R. F., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Riverside Metal Co., Riverside, N. J.
Seymour Mfg. Co., Seymour, Conn.

Phosphor Bronze, Cored Bars.
Atkinson Co., The, Rochester, N. Y.

Phosphor Bronze Sheets, Wire, Rods, Etc.
Bridgeport Brass Co., Bridgeport, Conn.
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Pilling Brass Co., Waterbury, Conn.
Riverside Metal Co., Riverside, N. J.
Seymour Mfg. Co., Seymour, Conn.

Phosphor Copper and Phosphor Tin.
Ajax Metal Co., Philadelphia, Pa.
Atkinson Co., The, Rochester, N. Y.
Damascus Bronze Co., Pittsburg, Pa.
Electric Smelt. & Aluminum Co., Lockport, N. Y.
Lang, R. F., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Co., Riverside, N. J.
Roessler & Hasslacher Chemical Co., New York.

Phosphorizers (See Crucibles, Etc.).

Phosphorus (See also Foundry Supplies).
General Chemical Co., Philadelphia, Pa.

Pickling Compounds.
Hanson & Van Winkle Co., Newark, N. J.

Pickling Machines, Automatic.
Torrington Manufacturing Co., Torrington, Conn.

Pin Machines (See Automatic Wire and Metal Working Machines).

Plastic Bronze.
Ajax Metal Co., Philadelphia, Pa.
Fitz, Dana & Co., Boston, Mass.

Plater Sheet Metal (See Metals, Plated Sheet).

Platers' Compound (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
International Chemical Co., Camden, N. J.
Wiarda & Co., John C., Brooklyn, N. Y.

Platers' Metal (See also Platers' Supplies).
Kemp, W. H., Co., New York.
Pilling Brass Co., Waterbury, Conn.

Platers', Polishers' and Galvanizers' Equipment and Supplies.
Abbott Ball Co., Hartford, Conn.
Ames Sword Co., Chicopee, Mass.
Anthony, H. M., Co., New York.
Apothecaries Hall Co., Waterbury, Conn.
Baird Machine Co., Bridgeport, Conn.
Baltimore Tube Co., Baltimore, Md.

ADVERTISERS' PRODUCTS AND BUYERS' GUIDE

Bogue, Chas. J., Electric Co., New York.
Burns, E. Reed, Supply Co., Brooklyn, N. Y.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Cooper, Charles, & Co., New York.
Crown Rheostat & Supply Co., Chicago, Ill.
Ele-Kem Co., Chicago, Ill.
Gardner Machine Co., Beloit, Wis.
General Platers' Supply Co., New York.
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
International Chemical Co., Camden, N. J.
Lang, R. F., New York.
Leiman Bros., New York.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Mendelson's, A., Sons, Albany, N. Y.
Moyer, D. B., Detroit, Mich.
Munning-Loeb Co., Matawan, N. J.
No-Dust Drying Machine Co., Providence, R. I.
Osborn Mfg. Co., Cleveland, O.
Parsons, W. R., Chicago, Ill.
Rhodes, James H., & Co., New York.
Roessler & Hasslacher Chemical Co., New York.
Rojas Electro Chemical Co., New York.
Smith, Richardson Co., Attleboro, Mass.
Solvay Process Co., Syracuse, N. Y.
Stevens, Frederic B., Detroit, Mich.
Tolhurst Machine Works, Troy, N. Y.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.
Wiarda & Co., John C., Brooklyn, N. Y.
Wyckoff, H. S., & Co., Newark, N. J.

Plating, Job.
Hassall, John, Inc., Brooklyn, N. Y.
Hudson Electro Plating & Polishing Co., New York.
Root, C. J., & Co., Bristol, Conn.
Two Rivers Plating Works, Two Rivers, Wis.

Plating Solutions.
Munning-Loeb Co., Matawan, N. J.
Rojas Electro Chemical Co., New York.

Platinum, Sheet and Wire.
Roessler & Hasslacher Chemical Co., New York.

Platinum Scrap, Buyers of.
Radnai, Josef, New York.
Roessler & Hasslacher Chemical Co., New York.

Plumbago (See Graphite).

Pneumatic Tool Hose and Supplies.
Harrison Supply Co., Boston, Mass.

Pointing Machines (See Automatic Wire and Metal Working Machinery).

Polishing and Buffing Compositions (See also Platers' Supplies).
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Munning-Loeb Co., Matawan, N. J.
Stevens, Frederic B., Detroit, Mich.
Woodison Co., E. J., Detroit, Mich.

Polishing, Buffing and Burnishing Machinery and Appliances (See also Platers' Supplies).
Abbott Ball Co., Hartford, Conn.
American Tool & Machine Co., Boston, Mass.
Ames Sword Co., Chicopee, Mass.
Apothecaries Hall Co., Waterbury, Conn.
Baird Machine Co., Bridgeport, Conn.
Baltimore Tube Co., Baltimore, Md.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Gardner Machine Co., Beloit, Wis.
General Platers' Supply Co., New York.
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
Knickerbocker Co., Jackson, Mich.
Leiman Bros., New York.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Moyer, D. B., Detroit, Mich.
Munning-Loeb Co., Matawan, N. J.
No-Dust Drying Machine Co., Providence, R. I.
Ohio Blower Co., Cleveland, O.
Osborn Mfg. Co., Cleveland, O.
Parsons, W. R., Chicago, Ill.
Pfleghar Hardware Sp'lty Co., New Haven, Conn.
Smith Richardson Co., Attleboro, Mass.
Stevens, Frederic B., Detroit, Mich.
Tolhurst Machine Works, Troy, N. Y.
Wyckoff, H. S., Co., Newark, N. J.

Polishing (See Polishing, Electroplating, Etc.).

Polishing Belts, Endless (See also Platers' Supplies).
Ames Sword Co., Chicopee, Mass.
Munning-Loeb Co., Matawan, N. J.

Potash (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Cooper, Charles, & Co., New York.
International Chemical Co., Camden, N. J.
Mendelson's, A., Sons, Albany, N. Y.
Moyer, D. B., Detroit, Mich.
Munning-Loeb Co., Matawan, N. J.
Niagara Falls Alkali Co., Niagara Falls, N. Y.
Roessler & Hasslacher Chemical Co., New York.
Wiarda & Co., John C., Brooklyn, N. Y.

Presses, Bench and Foot.
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Company, Brooklyn, N. Y.
Leiman Bros., New York.
Shuster, The F. B., Co., New Haven, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Presses, Cabbaging.
Farrel Foundry & Machine Co., Ansonia, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Wood, R. D., & Co., Philadelphia, Pa.
Watson-Stillman Co., New York.

Presses, Coining.
Bliss, E. W., Co., Brooklyn, N. Y.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Presses, Drop.
Bliss, E. W., Co., Brooklyn, N. Y.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Presses, Power.
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Farrel Foundry & Machine Co., Ansonia, Conn.
Garrison, A., Foundry Co., Pittsburg, Pa.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Pressure Blowers (See also Foundry Supplies).
Eclipse Air Brush & Compressor Co., Newark, N. J.
Eureka Pneumatic Spray Co., New York.
International Spray Co., New York.
Leiman Bros., New York.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Whiting Foundry Equipment Co., Harvey, Ill.

Pumice (See also Platers', Polishers' and Galvanizers' Supplies).
Rhodes, James H., & Co., New York.

Pyrometers.
Bristol & Co., The, Waterbury, Conn.

Recording Instruments for Heat, Pressure, Etc.
Bristol & Co., The, Waterbury, Conn.

Rheostats.
Crown Rheostat & Supply Co., Chicago, Ill.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Munning-Loeb Co., Matawan, N. J.

Riddles (See also Foundry Supplies).
Stevens, Frederic B., Detroit, Mich.

Rifled Tubing.
Baltimore Tube Co., Baltimore, Md.

Riveting Machines.
Shuster, The, F. B., Co., New Haven, Conn.
Wood, R. D., & Co., Philadelphia, Pa.

Rivets—Brass, Aluminum, Etc.
Hassall, John, Inc., New York.
Hendricks Bros., New York.
Kemp, W. H., Co., New York.

Rojas Process of Electro Deposition.
Rojas Electro-Chemical Co., New York.

Roll-Grinding Machines.
Farrel Foundry & Machine Co., Ansonia, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Rolls, Chilled and Sand.
Farrel Foundry & Machine Co., Ansonia, Conn.
Garrison, A., Fdy. & Machine Co., Pittsburg, Pa.
Torrington (Conn.) Farrel Foundry & Machine Co.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Rolls, Jewelers'.
Leiman Bros., New York.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Rolling Mill Machinery.
Farrel Foundry & Machine Co., Ansonia, Conn.
Garrison, A., Fdy. & Machine Co., Pittsburg, Pa.
Thompson, Guion, Waterbury, Conn.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Rouge (See also Platers' Supplies).
General Platers' Supply Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
Rhodes, James H., & Co., New York.
Woodison Co., E. J., Detroit, Mich.

Rust Proof Process (See also Galvanizing).
Ele-Kem Co., Chicago, Ill.

Salt Water Gold Plating Outfits.
Wyckoff, H. S., Co., Newark, N. J.

Sand, Fire (See also Foundry Supplies).
Paxson, J. W., Co., Philadelphia, Pa.

Sand for Blasting.
Paxson, J. W., Co., Philadelphia, Pa.

Sand, Crushed Steel, For Blasting.
Pittsburg Crushed Steel Co., Pittsburg, Pa.

Sand Blast Machinery and Equipment.
Leiman Bros., New York.
Paxson, J. W., Co., Philadelphia, Pa.
Sly, W. W., Mfg. Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.

Sand Blast Systems.
Paxson, J. W., Co., Philadelphia, Pa.
Sly, W. W., Mfg. Co., Cleveland, O.

Sand Blast Tumbling Barrels.
Paxson, J. W., Co., Philadelphia, Pa.
Sly, W. W., Mfg. Co., Cleveland, O.

Sand Dryers, Sifters and Mixers (See also Foundry Supplies).
Osborn Mfg. Co., Cleveland, O.
Turner Machine Co., Philadelphia, Pa.

Sand, Molding (See also Foundry Supplies).
Newport Sand Bank Co., Newport, Ky.
Paxson, J. W., Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.

Sawdust, Boxwood, for Drying Purposes (See also Platers' Supplies).
Burns, E. R., Supply Co., Brooklyn, N. Y.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Sommers, John, Faucet Co., Newark, N. J.

Sawdust Drying-Out Boxes (See also Platers' Supplies).
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
No-Dust Drying Machine Co., Providence, R. I.
Smith, Richardson Co., Attleboro, Mass.
Steiner, E. E., Newark, N. J.

Scrap Metal (See Metal Turnings, Drosses, Residues, Etc.).

Separators, Oil and Steam.
Ohio Blower Co., Cleveland, O.

Shanks, Ladle and Crucible.
Whiting Foundry Equipment Co., Harvey, Ill.

Shears, Power.
Bliss, E. W., Co., Brooklyn, N. Y.
Farrel Foundry & Machine Co., Ansonia, Conn.
Garrison, A., Fdy. & Machine Co., Pittsburgh, Pa.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Sheet Metal Straightening, Cutting and Forming Machinery.
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Farrel Foundry & Machine Co., Ansonia, Conn.
Shuster, The F. B., Co., New Haven, Conn.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Sherardizing (See also Galvanizing).
Globe Machine & Stamping Co., Cleveland, O.

Sherardizing Ovens.
Gehnrich, Hermann, New York.
Globe Machine & Stamping Co., Cleveland, O.
Monarch Engineering & Mfg. Co., Baltimore, Md.

Shop Furniture, Etc.
Sly, W. W., Mfg. Co., Cleveland, O.

Silicon.
Leavitt, C. W., & Co., New York.

Silicon Copper.
Ajax Metal Co., Philadelphia, Pa.
Damascus Bronze Co., Pittsburgh, Pa.
Electric Smelting & Alum'm Co., Lockport, N. Y.
Lang, R. F., New York.
Roessler & Hasslacher Chemical Co., New York.

Silver and Gold Granulated.
Jackson, John J., & Co., Newark, N. J.
Ney, J. M., Co., Hartford, Conn.

Silver Cyanide.
Apothecaries Hall Co., Waterbury, Conn.
Roessler & Hasslacher Chemical Co., New York.

Silver, Nitrate and Chloride of (See also Platers' Supplies).
General Platers' Supply Co., New York.
Jackson, John J., & Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.

Silver Ingots, Bars, Plates, Etc.
Ney, J. M., Co., Hartford, Conn.
Renziehausen, Wm. F., Co., Newark, N. J.

Silver Refiners.
Jackson, John J., & Co., Newark, N. J.
Ney, J. M., Co., Hartford, Conn.
Renziehausen, Wm. F., Co., Newark, N. J.
Roessler & Hasslacher Chemical Co., New York.

Silver, Rolled Sterling.
Jackson, John J., & Co., Newark, N. J.
Ney, J. M., Co., Hartford, Conn.
Renziehausen, Wm. F., Co., Newark, N. J.
Riverside Metal Co., Riverside, N. J.

Silver Solder.
Jackson, John J., & Co., Newark, N. J.
Ney, J. M., Co., Hartford, Conn.

Silver Trisalyt.
Roessler & Hasslacher Chemical Co., New York.

Silver Wire.
Jackson, John J., & Co., Newark, N. J.

Slitting Machines.
Torrington Mfg. Co., Torrington, Conn.

Smelters of Copper-Bearing Materials.
Ajax Metal Co., Philadelphia, Pa.
Balbach Smelting & Refining Co., Newark, N. J.

Smelters, Sweep.
Ney, J. M., Co., Hartford, Conn.
Renziehausen, Wm. F., Co., Newark, N. J.

Soap (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
International Chemical Co., Camden, N. J.
Munning-Loeb Co., Matawan, N. J.
Wiards, John C., & Co., Brooklyn, N. Y.
Wyckoff, H. S., Co., Newark, N. J.

Solder, Aluminum.
Aluminum Company of America, Pittsburg, Pa.
Aluminum Solder & Refining Co., Syracuse, N. Y.
Atkinson Co., The, Rochester, N. Y.
Electric Smelt. & Aluminum Co., Lockport, N. Y.
Kemp, W. H., Co., New York.
Richards & Co., Boston, Mass.
U. S. Reduction Co., Chicago, Ill.

Solder, Brazing.
Ajax Metal Co., Philadelphia, Pa.
Hussey, C. G., & Co., Pittsburg, Pa.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.

Solder, Hard, for Cast Iron.
Lang, R. F., New York.

Solder, Wire.
Brooks Solder & Metal Works, Baltimore, Md.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Soldering Flux.
Crown Rheostat & Supply Co., Chicago, Ill.
Ele-Kem Co., Chicago, Ill.
L'Hommedieu, Chas. F., Sons & Co., Chicago, Ill.

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Richards & Co., Boston, Mass.
Wiarda, John C., & Co., Brooklyn, N. Y.

Soldering Irons.
Hendricks Bros., New York.
Hussey, C. G., & Co., Pittsburg, Pa.
Taunton-New B'f'd Copper Co., New Bedford, Mass.

Solder Molds.
Schweizer, Chas. K., Co., St. Louis, Mo.

Solder, Silver.
Jackson, John J., & Co., Newark, N. J.

Solder, Tinners'.
Atkinson Co., The, Rochester, N. Y.
Brooks Solder & Metal Works, Baltimore, Md.
Columbia Smelting & Refining Works, New York.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Refining Co., Connellsville, Pa.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Soluble, Cotton.
Inter. Smokeless Powder & Chem. Co., New York.
Wiarda & Co., John C., Brooklyn, N. Y.

Special Machinery.
Wilkes Mfg. Co., Philadelphia, Pa.

Specialties, Steam and Water.
Ohio Blower Co., Cleveland, O.

Spelter.
Birkenstein, S., & Sons, Chicago, Ill.
Brooks Solder & Metal Works, Baltimore, Md.
Damascus Bronze Co., Pittsburg, Pa.
Genesee Metal Co., Rochester, N. Y.
Hegeler Bros., Danville, Ill.
Hendricks Bros., New York.
Illinois Smelting & Refining Co., Chicago, Ill.
Illinois Zinc Co., Peru, Ill.
Leavitt, C. W., & Co., New York.
Matthiesen & Hegeler Zinc Co., La Salle, Ill.
Michigan Smelting & Refining Co., Detroit, Mich.
New Jersey Zinc Co., The, New York.
Richards & Co., Boston, Mass.
Sandoval Zinc Co., Chicago, Ill.
Trotter, Nathan, & Co., Philadelphia, Pa.
U. S. Reduction Co., Chicago, Ill.
Walsh's Sons, M. I., & Co., Newark, N. J.

Spelter Kettles (See Crucibles, etc.).

Spinning Lathes.
Bliss, E. W., Co., Brooklyn, N. Y.
Pryibil, P., Inc., New York.
Wilcor Manufacturing Co., Chicago, Ill.

Spinning, Metal (See also Metal Goods made to order).
Eberhard, George, Providence, R. I.
Riverside Metal Co., Riverside, N. J.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Sponges.
Rhodes, James H., & Co., New York.

Spraying Hoods, Tables, Etc.
De Vilbiss Co., Toledo, O.
Eureka Pneumatic Spray Co., New York.

Spraying Machines.
De Vilbiss Co., Toledo, O.
Eclipse Air Brush & Compressor Co., Newark, N. J.
Eureka Pneumatic Spray Co., New York.
International Spray Co., New York.

Sprue Cutters (See also Foundry Supplies).
Bliss, E. W. Co., Brooklyn, N. Y.
Coleman Foundry Equipment Co., Cleveland, O.
Shuster, The F. B., Company, New Haven, Conn.
Stevens, Frederic B., Detroit, Mich.
Turner Machine Co., Philadelphia, Pa.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Stampings, Metal (See also Metal Goods made to order).
Globe Machine & Stamping Co., Cleveland, O.
Riverside Metal Co., Riverside, N. J.
Root, C. J., & Co., Bristol, Conn.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Wilkes Mfg. Co., Philadelphia, Pa.

Steel, Crushed, Abrasives.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

Steel Shop Fittings.
Sly, W. W., Mfg. Co., Cleveland, O.

Steel Tubing, Thin Gauges.
Baltimore Tube Co., Baltimore, Md.

Sterling Silver Sheets.
Jackson, John J., Newark, N. J.

Stirrers, Graphite (See Crucibles, etc.).

Stoneware, Chemical.
German-American Stoneware Works, New York.

Stoneware Exhaust Fans.
German-American Stoneware Works, New York.

Stoneware Tanks, Dipping Baskets, Etc.
Burns, E. R., Supply Co., Brooklyn, N. Y.
German-American Stoneware Works, New York.
L'Hommedieu, Chas. F., Sons & Co., Chicago, Ill.
Munning-Loeb Co., Matawan, N. J.

Sulphuret of Potassium.
Apothecaries Hall Co., Waterbury, Conn.
Roessler & Hasslacher Chemical Co., New York.
Wiarda, John C., & Co., Brooklyn, N. Y.

Sweep Smelters Mixing Machine.
Moussette, O. J., Co., Brooklyn, N. Y.

Sweep Smelters (See Smelters, Sweep).

Tacks (See name of metal wanted).

Tanks, Electroplaters' (See also Platers' Supplies).
Burns, E. R., Supply Co., Brooklyn, N. Y.
Chadwick-Boston Lead Co., Boston, Mass.
German-American Stoneware Works, New York.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
Moyer, D. B., Detroit, Mich.
Stearns, The A. T., Lumber Co., Boston, Mass.
Stevens, Frederic B., Detroit, Mich.
Wiarda & Co., John C., Brooklyn, N. Y.

Tanks, Stoneware.
German-American Stoneware Works, New York.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.

Testing Laboratories.
Dover Laboratory, Dover, N. J.
Ledoux & Co., New York.

Tin, Chloride of.
Apothecaries Hall Co., Waterbury, Conn.
Wiarda & Co., John C., Brooklyn, N. Y.

Tinning Equipment.
Globe Machine & Stamping Co.
Hanson & Van Winkle Co., Newark, N. J.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Tin, Pig, Bar and Block.
Birkenstein, S., & Sons, Chicago, Ill.
Brooks Solder & Metal Works, Baltimore, Md.
Hendricks Bros., New York.
Leavitt, C. W., & Co., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Richards & Co., Boston, Mass.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Trotter, Nathan, & Co., Philadelphia, Pa.
U. S. Reduction Co., Chicago, Ill.

Tin Tubing.
Brooks Solder & Metal Works, Baltimore, Md.
Chadwick-Boston Lead Co., Boston, Mass.
Michigan Smelting & Refining Co., Detroit, Mich.

Tin, Sheet Block.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Titanium Alloys.
Goldschmidt Thermit Co., New York.

Tobin Bronze.
American Bronze Co., Waterbury, Conn.

Tongs, Crucible and Pick-Up.
Whiting Foundry Equipment Co., Harvey, Ill.

Tool-Makers and Machinists.
Smillie, C. M., Detroit, Mich.

Tripoli Composition (See also Platers' and Polishers' Supplies).
Burns, E. R., Supply Co., Brooklyn, N. Y.
General Platers' Supply Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Munning-Loeb Co., Matawan, N. J.
Stevens, Frederic B., Detroit, Mich.
Wiarda, John C., & Co., Brooklyn, N. Y.

Tripoli Flour (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Cooper, Charles, & Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
Stevens, Frederic B., Detroit, Mich.
Wiarda, John C., & Co., Brooklyn, N. Y.

Trisalyt Triple Salts.
Roessler & Hasslacher Chemical Co., New York.

Tube Bending Machines.
Baltimore Tube Co., Baltimore, Md.

Tube Machinery.
Farrel Foundry & Machine Co., Ansonia, Conn.
Torrington Mfg. Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Tube Polishing Machines.
Baltimore Tube Co., Baltimore, Md.

Tubes (See name of metal wanted).

Tumbling Barrels (See also Foundry Supplies and Platers' Supplies).
Abbott Ball Co., Hartford, Conn.
Baird Machine Co., Bridgeport, Conn.
Coleman Foundry Equipment Co., Cleveland, O.
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas F., & Sons Co., Chicago, Ill.
Munning-Loeb Co., Matawan, N. J.
Moyer, D. B., Detroit, Mich.
Northern Engineering Works, Detroit, Mich.
Osborn Mfg. Co., Cleveland, O.
Paxson, J. W., Co., Philadelphia, Pa.
Sly, W. W., Mfg. Co., Cleveland, O.
Smith, Richardson Co., Attleboro, Mass.
Stevens, Frederic B., Detroit, Mich.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Whiting Foundry Equipment Co., Harvey, Ill.

Type Metal.
Ajax Metal Co., Philadelphia, Pa.
Brooks Solder & Metal Works, Baltimore, Md.
Columbia Smelting and Refining Works, New York.
Illinois Smelting & Refining Co., Chicago, Ill.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Refining Co., Connellsville, Pa.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Turntables, Cars, Etc.
Whiting Foundry Equipment Co., Harvey, Ill.

Vacuum Pumps.
Leiman Bros., New York.

Vanadium Alloys.
Goldschmidt Thermit Co., New York.

Ventilators and Apparatus (See Dust Collectors, Etc.).

Vienna Lime Compositions (See also Platers', Polishers', and Galvanizers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.

Voltmeters (See also Platers', Polishers' and Galvanizers' Supplies).
Bristol Co., The, Waterbury, Conn.
Crown Rheostat & Supply Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.

Wattmeters.
Bristol, The, Co., Waterbury, Conn.

Wax Wire (See also Foundry Supplies).
Stevens, Frederic B., Detroit, Mich.

Whale Oil Soap.
Apothecaries Hall Co., Waterbury, Conn.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
International Chemical Co., Camden, N. J.
Wiarda, John C., & Co., Brooklyn, N. Y.

White Finish (See also Platers' Supplies).
Burns, E. R., Supply Co., Brooklyn, N. Y.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.

White Metal Ingots and Castings.
Ajax Metal Co., Philadelphia, Pa.
Brooks Solder & Metal Works, Baltimore, Md.
Columbia Smelting & Refining Works, New York.
Illinois Smelting & Refining Co., Chicago, Ill.
Riverside Metal Refining Co., Connellsville, Pa.

White Metal Rolling for the Trade.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Wire (See name of metal wanted).

Wire Coilers.
Baird Machine Co., Bridgeport, Conn.
Torrington Manufacturing Co., Torrington, Conn.

Wire Goods Manufacturers (See also Metal Goods made to order).
Baird Machine Co., Bridgeport, Conn.

Wire Mill Equipment.
Farrel Foundry & Machine Co., Ansonia, Conn.
Torrington Mfg. Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Wire Nails, All Metals.
Hassall, John, Inc., Brooklyn, N. Y.

Wire Straightening and Forming Machinery.
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Shuster, The F. B., Co., New Haven, Conn.

Wire Wheel and Hand Brushes (See also Foundry Supplies).
Hanson & Van Winkle Co., Newark, N. J.
Manufacturers' Brush Co., Cleveland, O.
Osborn Mfg. Co., Cleveland, O.
Paxson, J. W., Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.

Zinc Battery Plates.
Matthiesen & Hegeler Zinc Co., La Salle, Ill.

Zinc, Chloride of (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Cooper, Charles, & Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
Richards & Co., Boston, Mass.
Roessler & Hasslacher Chemical Co., New York.
Sandoval Zinc Co., Chicago, Ill.
Wiarda & Co., John C., Brooklyn, N. Y.

Zinc, Cold Rolled, in Coil.
Platt Bros. Co., Waterbury, Conn.

Zinc Cyanide.
Apothecaries Hall Co., Waterbury, Conn.
Roessler & Hasslacher Chemical Co., New York.

Zinc, Dust (See also Platers' Supplies).
Cooper, Charles, & Co., New York.
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
Leavitt, C. W., & Co., New York.
New Jersey Zinc Co., New York.
Roessler & Hasslacher Chemical Co., New York.
Wiarda & Co., John C., Brooklyn, N. Y.

Zinc Salts, Commercial (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Cooper, Charles, & Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Sandoval Zinc Co., Chicago, Ill.
Wiarda & Co., John C., Brooklyn, N. Y.

Zinc Sheet and Plate.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Illinois Zinc Co., Peru, Ill.
Matthiesen & Hegeler Zinc Co., La Salle, Ill.
National Sheet Metal Co., Peru, Ill.
Pilling Brass Co., Waterbury, Conn.
Platt Bros. Co., Waterbury, Conn.
Richards & Co., Boston, Mass.

Zinc Trisalyt.
Roessler & Hasslacher Chemical Co., New York.

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